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Electrical Contracting

SEPTEMBER • 1943

INDUSTRIAL ELECTRIFICATION SECTION ..... Pages 63-78

The Magazine of

ELECTRICAL CONSTRUCTION AND MAINTENANCE

UMI

BEFORE BUYING A TRANSFORMER

ASK YOURSELF THESE QUESTIONS

1 Can the transformer be installed indoors, at the load center, where voltage drop would be reduced and copper saved?

2 Will an indoor installation require an expensive fire-proof vault or fire wall?

3 Does the surrounding air contain impurities which might adversely affect transformer reliability and life?

4 Can lightning surges and switching transients reach the transformer, either direct or through the main supply transformer?

5 In a plant rearrangement later, is it likely that the transformer will be moved outdoors, or to some other indoor location?

6 How much maintenance will be required?

7 In an emergency, will the transformer handle sustained overloads?

8 Is there any chance that the transformer will sometime be partially or totally submerged in water?

Reg. U.S. Pat. Off.

GET THE RIGHT ANSWER WITH PYRANOL TRANSFORMERS

1 You can ***safely*** install Pyranol* transformers indoors. Never has one burned or contributed to a fire.

2 No vaults are required with Pyranol transformers. You can install them anywhere (even on the roof, in the basement, or on overhead beams), thus saving time, floor space, and construction materials.

3 Pressure-tight tanks protect the vital parts of Pyranol transformers from dust, dirt, fumes, dampness, and accidental damage.

4 Pyranol transformers have high impulse strength against voltage surges—permitting dependable protection by valve-type arresters.

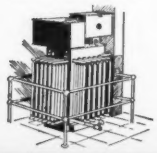
5 The completely sealed tanks of Pyranol transformers make any future change to an ***outdoor*** installation "a natural." Their inherent safety makes it possible to relocate them ***indoors*** anytime, anywhere.

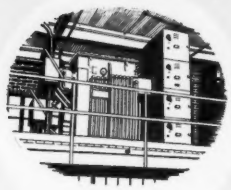
6 Because dust, dirt, and moisture can't get into a Pyranol transformer, and since Pyranol is nonoxidizing and nonsludging, little or no maintenance is necessary.

7 The heat-storage capacity of the core-and-coils and of the cooling liquid make the Pyranol transformer ideal for sustained emergency overloads.

8 Pyranol transformers are pressure-tight. Even after three days' submersion in a torpedoed tanker, Pyranol transformers were found unharmed.

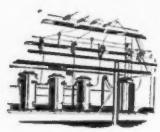
ON THE FACTORY FLOOR

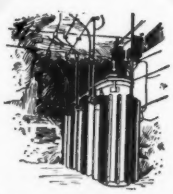




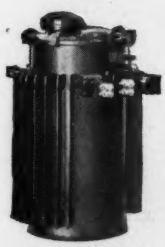
ON OVERHEAD BEAMS

ON ROOF TOPS





IN MINES



ALL-PURPOSE

PYRANOL TRANSFORMERS

For further information ask your G-E representative, or write for Bulletin GES-2974. *General Electric Company, Schenectady, N. Y.*

BUY WAR BONDS

GENERAL ELECTRIC

402-61-5100

"A FIRST CLASS INSTALLATION", *say electricians*

(*and they also say,* "SO EASY TO PUT IN")

Arc-quenching construction in 2, 3 and 4 Pole, 30, 60 and 100 Ampere Safety Switches.

SKETCHED above is the switch block from a Murray Single Throw, Fusible, Type D, Safety Switch. In the circle is the outstanding feature — the double break blade and arc quenching chamber.

Each blade is provided with a double break — the arc is broken into two parts. The burning is greatly reduced by this feature. Whatever arc is formed at each of the two breaks is drawn into a narrow slot in the mounting base where it is lengthened-out and cooled — the effects co-acting to quench the arc almost instantly.

This arc-quenching construction coupled with those Murray Switch characteristics as ample wiring room, properly placed knockouts, good-looking cabinets, assure the electrician the satisfaction that comes from a first-class installation. Metropolitan Device Corporation, Brooklyn, New York.

Write for the facts — no obligation!

Murray

SAFETY SWITCHES

THERE ARE MURRAY JOBBERS EVERYWHERE

Keep On

BUYING WAR BONDS AND STAMPS

ELECTRICAL CONTRACTING, Published monthly, price 25 cents a copy. Vol. 42, No. 9 Allow at least ten days for change of address. RETURN POSTAGE GUARANTEED. All communications about subscriptions should be addressed to the Director of Circulation, Electrical Contracting, 330 West 42nd St., New York 18, N. Y. Subscription Rates—U. S. A., and Latin American Republics, $2.00 a year, $3.00 for two years, $4.00 for three years Canada $2.50 a year, $4.00 for two years, $5.00 for three years. Great Britain and British Possessions 18 shillings for one year, 36 shillings for three years. All other countries $3.00 a year, $6.00 for three years. Entered as second-class matter August 29, 1936, at Post Office, Albany, N. Y., under the Act of March 3, 1879. Printed in U. S.
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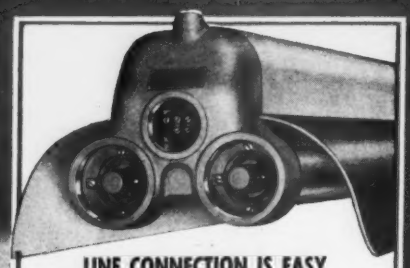
UMI

MARVEL OF SIMPLICITY

Skillful Design Cuts Costs in New, Exclusive . . .

Approved for All Class I, Groups C and D Class II, Groups E, F and G Hazardous Locations

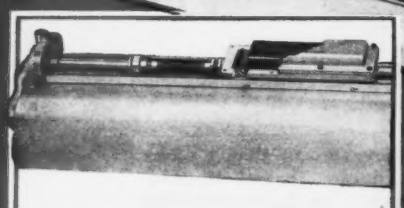


LINE CONNECTION IS EASY

End view with explosion-proof screw covers removed. Connecting block in upper hole simplifies installation. No other connections are made on the job. Lower holes show easily accessible starters, which can be replaced without removing lamps.

RE-LAMP IN A JIFFY

Two 40-watt, 48-inch, T-12 lamps, supported by wire cradles in tightly-sealed explosion-proof Pyrex tubes. Cradles seat lamps easily at far end. Special tool furnished for engaging electrodes in handling lamps.



BALLAST QUICKLY ACCESSIBLE

Mounted in explosion-proof housing at center of unit, under outer dust cover. Easily reached when replacement is necessary. Flexible coupling relieves any possible strain on Pyrex tubes. Highly-efficient, baked white enamel reflectors easily removed for washing.

APPLETON *Explosion-Proof* FLUORESCENT FIXTURE

Simple, low-cost installation and quick, easy maintenance are part of the design of the new Appleton Explosion-Proof Fluorescent Lighting Fixture. They're *built-in!*

Economy of man-hours makes doubly attractive the many advantages of fluorescent lighting in hazardous locations working night and day in war production. Allowing for the fact that all wiring must be tightly enclosed to guard against explosion, every operation in installation and maintenance is as simple as with ordinary fluorescent equipment. Additional maintenance cost is no factor.

Skillful Appleton engineering, so marked in this latest Appleton achievement, is common to all Appleton products—"Unilets," both regular and explosion-proof; lighting fixtures; conduit fittings; outlet and switch boxes. All of the thousands of types are carefully designed to install easily, to stand up on the job, to give maximum low-cost service.

Look carefully at the illustrations above, they'll tell you, *plainly,* why Appleton Explosion-Proof Fluorescent Lighting Fixtures should be in every hazardous location in your community—why it's wise, *on every job,* to specify Appleton equipment—"STANDARD FOR BETTER WIRING!"

Sold Through Wholesalers

APPLETON ELECTRIC COMPANY
1704 WELLINGTON AVENUE • CHICAGO, ILLINOIS

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Resident Representatives: Baltimore, Boston, Cincinnati, Dallas, Denver, Kansas City, Milwaukee, New Haven, New Orleans, Philadelphia, Seattle

APPLETON

CONDUIT FITTINGS • OUTLETS AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

UMI

OUR COVER—"Light for Ships" is the first of a series of original sketches by Stephen Grout depicting the many roles of our industry in total war. For those of our readers who want them, copies without lettering and suitable for framing are available at 25 cents each.

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A practical technical and management journal for electrical contractors, industrial electricians, inspection engineers and motor shops, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction and maintenance.

Electrical Contracting

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KEEP THIS LIGHT ALIVE...

By Maintaining *Plant Efficiency* Through

The RLM Label has stood as a sign of quality in industrial lighting for more than 20 years.

● Today . . . TONIGHT . . . with the United Nations on the attack . . . it is more important than ever to keep the flood of war goods rolling off the production lines. And foremost among plant efficiency "musts" is *good lighting*, for efficient seeing to banish eye strain and fatigue . . . two conditions to which the *older* workmen of today are especially susceptible.

To be sure of getting industrial lighting fixtures that can meet the severe service conditions of a month-in, month-out 24-hour war production schedule . . . specify RLM certified lighting units . . . identified by the RLM Label. RLM Certified Lighting Units are bulit to rigid specifications developed by RLM Standards Institute. Strict and continuous inspection by Electrical Testing Laboratories assures conformity to RLM Specifications by all manufacturers of RLM *Labeled* Industrial Lighting Units.

For full particulars, write any manufacturer or distributor of RLM Industrial Lighting Units, or to the RLM Standards Institute.

The Letters RLM Stand for Reflector and Lighting Equipment Manufacturers

RLM STANDARDS INSTITUTE
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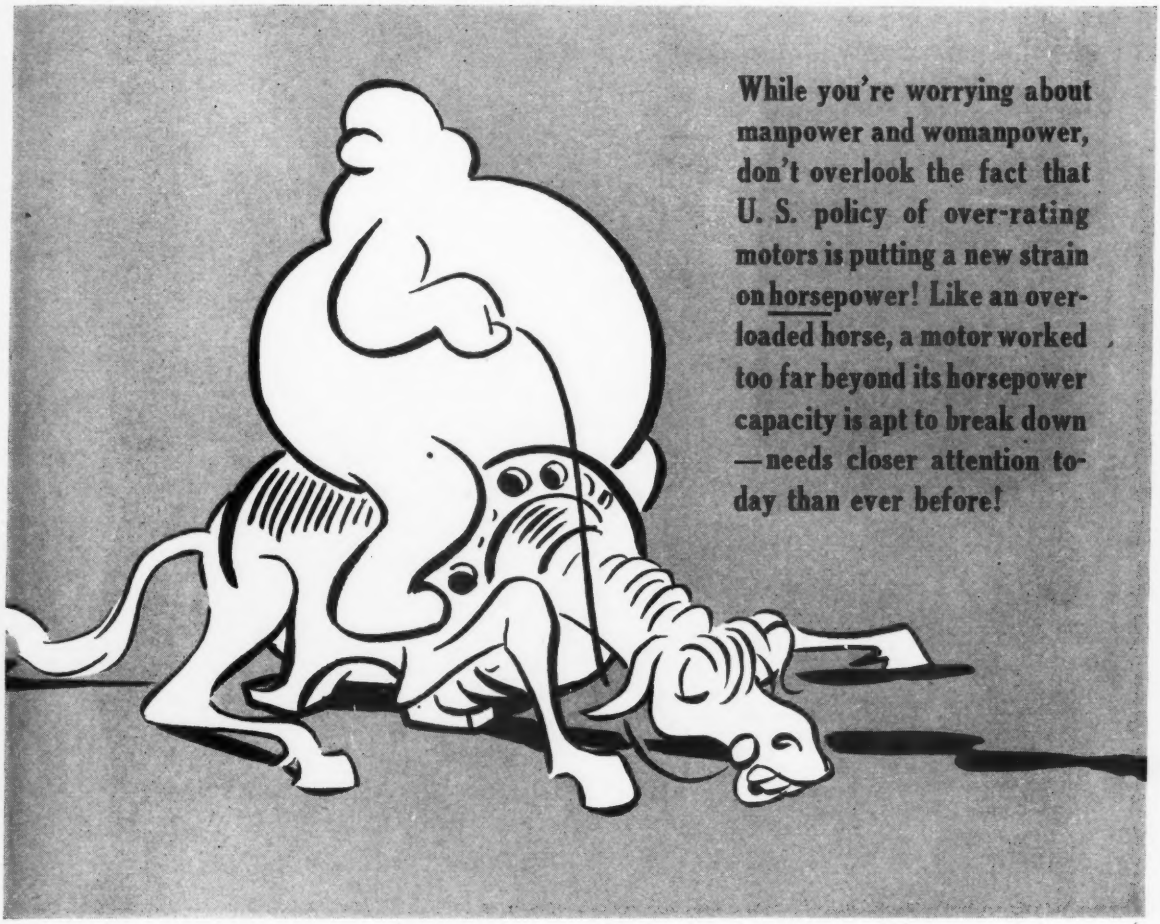
DON'T FORGET HORSEPOWER!


While you're worrying about manpower and womanpower, don't overlook the fact that U. S. policy of over-rating motors is putting a new strain on horsepower! Like an overloaded horse, a motor worked too far beyond its horsepower capacity is apt to break down—needs closer attention today than ever before!

WHAT WAS GOOD motor maintenance in peacetime, just isn't good enough today! Many motors are working *3 and 4 times* as many hours a week today . . . need wartime care . . . the kind set forth in Allis-Chalmers' new "Guide to Wartime Care of Electric Motors." This interesting, *fully illustrated* book looks at motor maintenance from a *new* perspective . . . describes in detail the 9 main enemies of motor life . . . tells you where to look for them, how to fight them. To experienced men it will serve as a valuable "refresher" . . . to new employees, as a *valuable training course.*

Over 100,000 copies are in use by the armed forces and war industry. World-wide demand has necessitated Spanish and Portuguese editions! "Guide to Wartime Care of Electric Motors" is *free!* Write for your copy. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 1639

ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.

AC WE WORK FOR VICTORY WE PLAN FOR PEACE

WHEN OUNCES FEEL LIKE POUNDS...

*Reg. U. S. Pat. Office

1230 SIXTH AVENUE
ROCKEFELLER CENTER, NEW YORK 20

UNITED

...ASSAULT TROOPS USE LAYTEX*

You know how it is. You slog along all day under full equip ment. At first you don't mind the weight very much. But as the hours crawl along, everything you're toting gets heavier and heavier. The canteen you didn't notice in the early stages now weighs as much as your rifle did then. And your rifle feels like a howitzer. Every ounce turns into a pound.

That's why . . . when you're moving fast and the going is tough . . . it's smart to use Laytex Assault Wire.

A full mile of Laytex Assault Wire weighs less than 30 pounds.

Laytex Assault Wire has a breaking strength of 50 pounds per conductor and a talking distance of more than 5 miles.

Laytex resists concussion and a wide range of temperature changes.

It is flexible and waterproof, strong and tough.

Conductors are accurately centered and the weight of insulation and the diameter of the insulated conductor are kept at the minimum.

All this adds up to the fact that one man, wearing a breast reel of Laytex Assault Wire can move swiftly and easily. One man can maintain sure communication with operational headquarters.

Listen to the Philharmonic Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

STATES RUBBER COMPANY

Make a good splice better with

Panther and Dragon Rubber Tapes

It is obvious that the wrapping of an insulated wire or cable splice with new insulation must be done so as to restore the insulating value of the original covering.

Only high grade compound, properly "plasticized" to obtain satisfactory electrical and physical properties, is used in the manufacture of PANTHER and DRAGON Rubber Tapes. It will mould into a homogeneous mass of insulation and vulcanize *after* application to the splice. It has high dielectric strength and insulation resistance. It more than complies with all the requirements of A.S. T.M. and Federal Emergency Specifications.

Investigate *all* the advantages of PANTHER and DRAGON Friction and Rubber Tapes and the reasons why they are being specified and used by electrical contractors throughout the country.

Sold Through Recognized Independent Wholesalers.

Friction tapes are available in both PANTHER and DRAGON Brands.

RUBBER TAPE

1. Guaranteed Footage
2. Substantial Fabric
3. High Tensile Strength
4. High Dielectric Strength
5. High Adhesive Strength
6. Uniform Thickness
7. Uniform Width
8. Excellent Tackiness
9. Strong, Durable Core
10. Colorful, Attractive Boxes

FRICTION TAPE

1. Guaranteed Footage
2. High Grade Compound
3. High Tensile Strength
4. High Elongation
5. High Dielectric Strength
6. Uniformity of Thickness and Width
7. Excellent Fusion
8. High Insulation Resistance
9. Excellent Tackiness
10. Colorful, Attractive Boxes

PANTHER & DRAGON
FRICTION AND RUBBER TAPES
HAZARD INSULATED WIRE WORKS — DIVISION OF THE OKONITE CO.
WILKES-BARRE, PENNSYLVANIA • OFFICES IN PRINCIPAL CITIES

2317

TO REDUCE KVA DEMAND OF RESISTANCE WELDERS

USE G-E PYRANOL CAPACITORS

Series-capacitor equipment for improving power factor of resistance-welding machines

The Conco Engineering Works, Mendota, Ill., reduced the kva demand of this welder from 150 kva to 54.6 kva by installing series capacitors (partly shown at left). A serious wiring and power-factor problem within the factory was solved, and a bad light flicker in town was eliminated. The capacitors added only 14 per cent to the installed cost of the welder.

PROBLEM

Welding loads present a problem to both resistance-welding machine users and utility companies. First, because the power demand is high, and the power factor is low. Second, the load is single phase, causing unbalance on polyphase systems. Third, the duty is highly intermittent, causing light flicker.

SOLUTION

Capacitors can be used in series with the primary of the welding transformer to reduce kva demand from the line by improving power factor to approximately unity.

RESULTS

- **More welding machines can be used on an existing feeder.**
- **Heavier welds are possible on the feeders where capacitors have been installed.**
- **Reduced interference with other welders on the same feeder.**
- **Welding machines can be installed on feeders too small to supply the usual low-power-factor machines.**
- **Removal or lessening of the restrictions sometimes required by power companies.**
- **Reduction of light flicker.**
- **Smaller feeder and power-supply equipment are needed for new welders.**
- **The necessity of running a separate feeder for a welder can probably be avoided.**
- **Special, low-impedance, power-supply transformers are not necessary.**
- **Long-throat machines will have practically the same kilowatt demand as short-throat machines.**

Application information can be obtained by asking for Bulletin GET-1134. For specific recommendations call your G-E representative. He'll be glad to help you. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

207-54-5700

UMI

TRUMBULL-PIONEERED

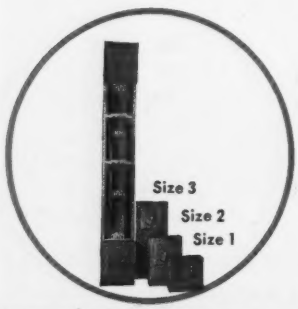
"packaged"

POWER CONTROL

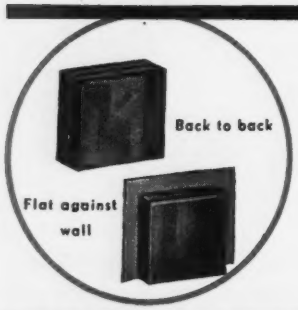
(PREFABRICATED SWITCHBOARDS)

MAKES CONTROL CENTER INSTALLATION

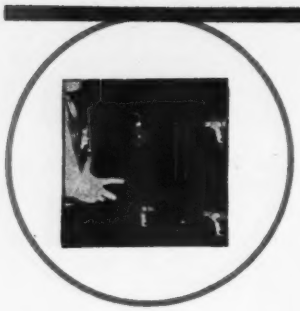
Simple as **a b c**



a ORDER STANDARDIZED STOCK SECTIONS AND UNITS



b ASSEMBLE & GROUP SECTIONS TO FIT YOUR NEEDS



c PLUG-IN REQUIRED CONTROL UNITS FROM FRONT

SAVES TIME... It used to take plenty of careful engineering and weeks of installation time to lay out power wiring and control equipment for a factory . . . until Trumbull pioneered application of the CONTROL CENTER idea. Now the engineering has already been done, and done well . . . on our time, not yours. You buy "packaged" units right out of stock. They are assembled, with almost "building block" simplicity, to give exactly the right combination of centralized switchboard or motor control equipment for your job . . . ready for power weeks or months sooner than possible under old-time schedules.

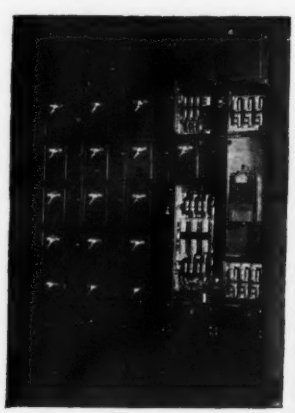
SAVES MATERIALS AND SPACE . . . Centralized Trumbull Control Center installations simplify feeder and machine wiring layout...use far less critical materials for a given load capacity, prevent waste in conduit and cable use. In large plants, control centers can be located centrally in production areas, BACK TO BACK OR AGAINST WALLS . . . requiring minimum space, all units, parts, and wiring connections ACCESSIBLE FROM FRONT . . . exclusive Trumbull features.

ASSURES FUTURE FLEXIBILITY . . . Vertical sections and interchangeable PLUG-IN TYPE control units provide flexibility never before possible . . . yet an exceedingly important factor in every plant today. Major revamping of an entire plant set up becomes possible by merely adding, subtracting or regrouping units and sections without any of the costly tie ups such work would ordinarily entail. Control Center installations made today provide the flexibility essential to war production and to later post-war reconversion.

This page merely covers the highlights. New Trumbullaid Bulletin No. 411 gives all the facts. Write for your copy today.

TRUMBULL

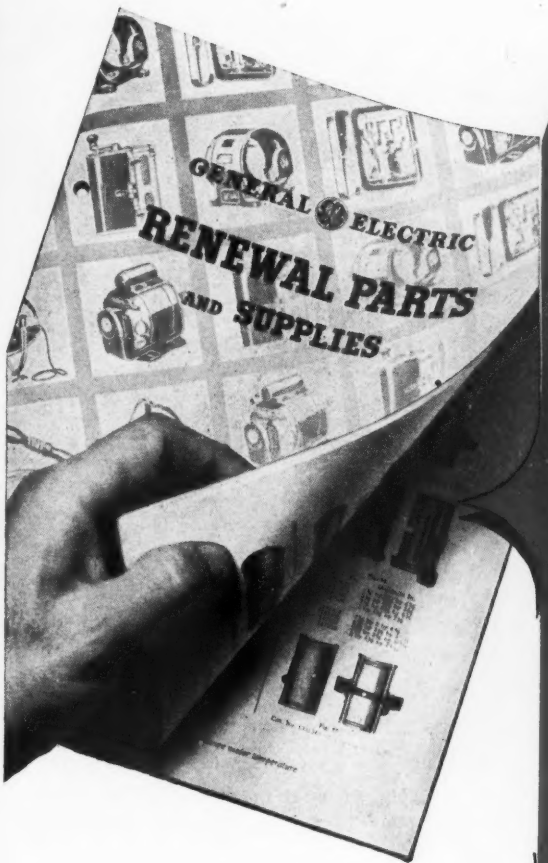
CONTROL CENTERS



THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

READY! Simplified Catalog of G-E Renewal Parts



HELPS GET PARTS FASTER

- ✓ Quickly identifies needed parts—pictorially!
- ✓ Simplifies ordering by catalog number
- ✓ Speeds delivery from G-E warehouses or factories
- ✓ Gives dimensions, descriptions, prices on all parts required most frequently
- ✓ Includes parts for G-E motors, control, switchgear and other widely used electric equipment; also supplies, such as magnet wire, insulating materials
- ✓ Makes it easier to order *genuine* G-E parts, for better fit and long-lasting performance

NOW, a single book—indexed for easy reference—can take the place of separate handbooks and bulletins for identifying and ordering most G-E renewal parts needed to keep your equipment in operation. With this book, you'll find it easier to order genuine G-E parts *by catalog number*—saving time all along the line.

For your copy, just mail the coupon. Even though you don't need it now, it may save precious hours in an emergency. *General Electric Company, Schenectady, N. Y.*

GENERAL ELECTRIC

General Electric Co., Section X 750-220
Schenectady, N. Y.

Yes, I want a copy of your new 96-page catalog "Renewal Parts and Supplies (GEA-638)" to help simplify ordering of genuine G-E parts.

Name.....

Company.....

Address.....

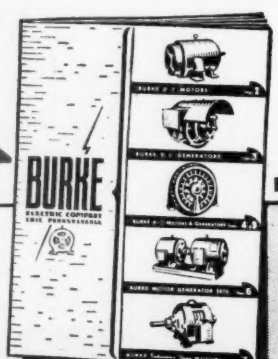
City..... State.....

226

What can BURKE do for Me?

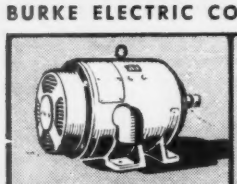
HERE'S a quick look at Burke Products to answer the headline question. When you examine each booklet, more specific questions will develop, questions that Burke engineers will be glad to answer.

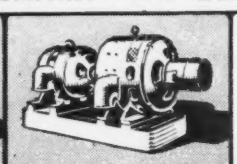
You may be surprised to learn that Burke pioneered and perfected the Universal Motor and the 3-Wire D. C. Generator, that Burke introduced the high cycle Motor Generator Set for powering High-speed Tools, and that Burke was first to use electric welding construction. In order to have you know Burke better we will be glad to send you a complete set of these Burke Bulletins.



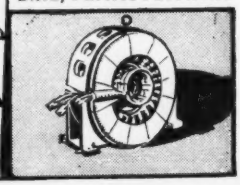
For quick reference to the Burke line, see Sweet's Catalog File and Electrical Buyers' Reference Catalog.

BURKE ELECTRIC COMPANY • 1205 WEST 12TH STREET ERIE, PENNSYLVANIA



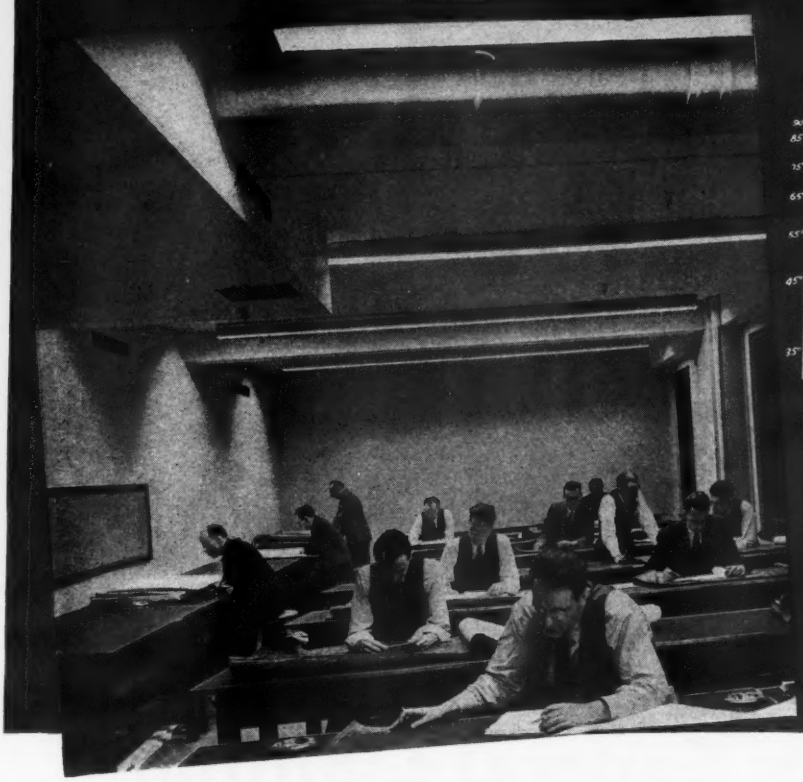


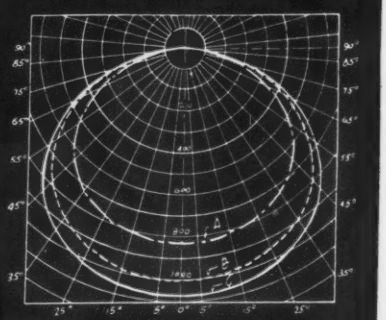
D.C. Equipment to 1500 H.P and 1000 K.W.
A.C. Equipment to 1500 H.P and 1000 K.W.
M-G Sets to 1000 K.W.
Molded Bakelite Terminal Blocks



Dirt wastes light

Clean reflectors help you maintain high production, reduce errors and accidents





Typical Reflector Light-Distribution Curves
A-Dirty B-Dry-wiped C-Washed

Clean, white walls and Alzak Aluminum Reflectors make it easier to maintain high working efficiency

A dirty surface absorbs a lot of light, whether it's the ceiling, lighting fixture or reflector itself. A regular cleaning program pays excellent dividends. Because better light means better sight, your production program is maintained at higher rates, accidents and errors are reduced.

Your Alzak* Aluminum reflectors were designed by their manufacturers to do a specific task, putting the kind of light you want right where you want it. They employed aluminum with an Alzak finish to assure that those reflectors could keep on doing that job well, with a minimum of attention. Their surface is glass-like, to which dirt does not readily cling. It won't scratch easily or chip.

In some locations, your Alzak Aluminum reflectors may only need an occasional wiping off with a soft, dry cloth to keep them working at high efficiency. Out of doors, or in the presence of dust and fumes, they may require washing with mild soap and water at regular intervals. Under more severe conditions, a more drastic cleaning method may be necessary.

How to maintain Alzak Aluminum reflectors is told in the booklet, "Instructions for the Protection and Maintenance of Alumilite Finishes and Alzak Reflectors." For a copy, write ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania.

*Registered trade-mark, Aluminum Company of America

ALCOA ALUMINUM

X-Ray
TRADE MARK REG.

SILVER MIRROR REFLECTORS

INCANDESCENT

Best for General Lighting

Now—give the most for every lighting dollar—more efficiency, less wasted light—by specifying "X-Ray" Reflectors on incandescent jobs involving general factory lighting and high bay installations.

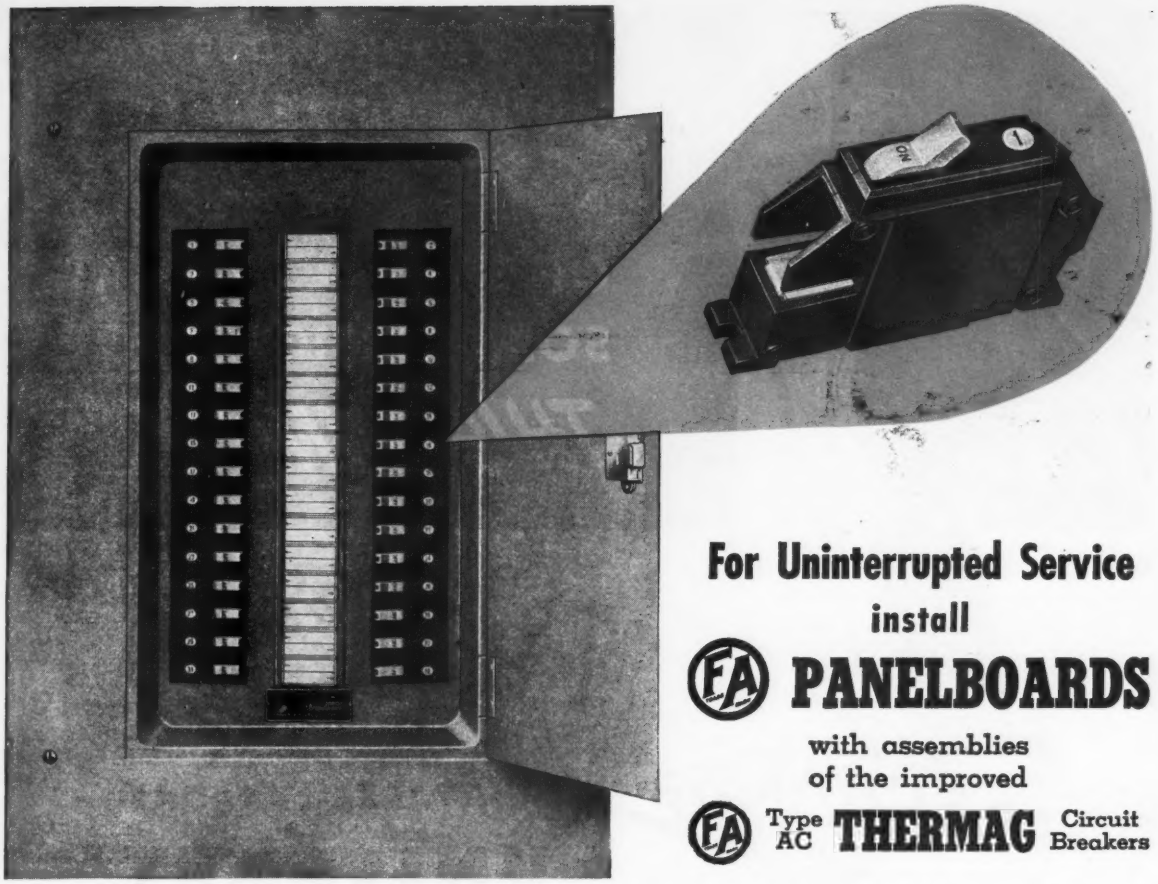
These Curtis Industrial Lighting Units are made of the highest quality silver mirror glass, the most efficient reflecting surface in commercial use, and are designed to provide maximum utilization of light. Employing a minimum of vital materials, they are the culmination of 46 years of engineering experience in the control of light with glass reflectors. They are protected for permanent efficiency and backed by the Curtis guarantee.

"X-Ray" Reflector jobs are easy to lay out and simple and economical to install and maintain. Write today for specification sheets.

Many types of "X-Ray" Industrial Lighting Reflector Units are available. The two most popular sizes are the 588 and 589 series. No. 588 is used with 500- or 300-watt incandescent lamps. With tripod holder it is No. 588-T. No. 589 is designed for 750- to 1500-watt incandescent or 400-watt Mercury lamps. Unit illustrated above is No. 589-T.

CURTIS LIGHTING, INC.

6135 W. 65TH STREET . . . . . CHICAGO



For Uninterrupted Service
install
(FA) PANELBOARDS
with assemblies of the improved
(FA) Type AC THERMAG Circuit Breakers

The Safety Panelboard above is Catalog No. (FA) NAC1B32-3L20. It contains 32 (FA) Type AC Thermag Circuit Breakers, and 200 ampere 3 wire main connection. An enlarged view of the individual Circuit Breaker is shown at the right.

They not only provide full protection against short circuits and dangerous overloads, *but prevent unnecessary interruptions in service* due to momentary or slight overloads.

The combination of the time-tried THERmal trip with the new MAGnetic trip, in the individual circuit breakers, assures this double protection. On harmless, momentary overload the time lag characteristics of the thermal element prevent interruption of service, but trip on sustained, harmful overload. On short circuit, the magnetic element causes *faster* tripping.

When tripped, the handle of the single pole breaker automatically returns to the OFF position, thus indicating the circuit affected. On the double pole breaker, a red signal button is protruded from the face of the breaker on which the trouble has occurred.

(FA) PANELBOARDS—THERMAG EQUIPPED

are made in Standard Type, Narrow Column Type, and Dust-tight Type construction. They are available with from 4 to 42 circuits, for either flush or surface mounting . . . Capacities: 50 amperes or less, 120 volts AC, single or double pole, individual trip . . . Approved by Underwriters' Laboratories, Inc.

Installation and connection are facilitated by new and improved (FA) Pressure Connectors. Ample knockouts are provided in the steel boxes. Fronts are bonderited, to prevent rusting, and finished in pearl gray lacquer.

Write for BULLETIN 69

Especially prepared for the use of Architects, Engineers and Contractors, it contains a mine of useable information on panelboards and cabinets. It is a real aid in planning and engineering electric distribution installations for light, heat and power. Write for your copy . . . Frank Adam Electric Co., St. Louis, Mo.

EST. 1891 — THE SIGN OF A (FA) BETTER JOB

Frank Adam

ELECTRICAL PRODUCTS

for War Industry

FRANK ADAM ELECTRIC CO. ST. LOUIS, MO. U.S.A.

UMI

DOES YOUR INDUSTRIAL SIGNAL BUYER NEED A *QUICK CHANGE* OF SIGNAL TYPE AT SOME CRITICAL SPOT *THIS MINUTE?*

All Right!

HE CAN HAVE IT IF HIS SIGNAL SYSTEM IS *SCHWARZE-FARADAY*

UNI-PACT

By using the Schwarze-Faraday UNI-PACT System, the user may instantly replace one type of signal with another by merely plugging-in to the standard Uni-Pact base, with choice of Bells, Horns and Kodaires.

There's a Schwarze-Faraday Horn, Bell, Trumpet, Kodaire, Siren, Buzzer, Chime or Gong to do every signal job that comes to you. Each one completely modern, powerful, dependable,—doing an essential job with essential perfection.

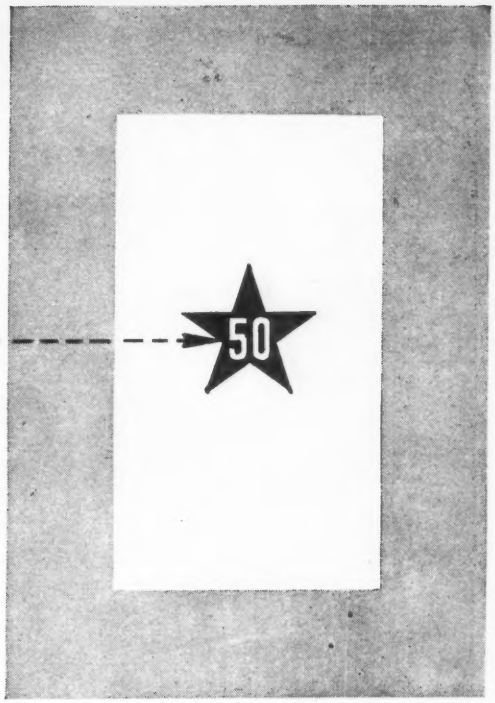
Our engineering service is at your call, to assist in designing efficient use of signal equipment in your customers' plants.

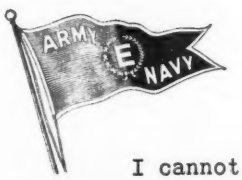
Our current catalog, designed for exceptionally easy use by means of distinctively colored sections, clear captions, and cross-indexing, is for your convenience in selling.

SCHWARZE ELECTRIC COMPANY

1909 CHURCH ST. • ADRIAN, MICHIGAN

an open letter to WIREMOLD men in the service...





Hartford, Connecticut

I cannot tell you how much personal satisfaction it gives me to report to you that your Company has been awarded the Army-Navy E for excellence in the production of the materials you need to fight with.

The men and women you worked with have earned this award by putting every ounce of their energy, and then some, into their particular jobs. Our part is a small one compared to the one all of you are playing, but in this man's war, every wheel must turn constantly and fast.

We can honestly say that one of the most important factors in spurring us on to the kind of effort we have achieved is our thoughts of those of you who have left to go into the armed forces. The work that has brought this Award is about the only way we have of telling you that we're in the outfield backing you up. You have our pledge that we will continue to do so.

Best of luck from all of us.

THE WIREMOLD COMPANY

D. Hayes Murphy

President

P.S. We are continually increasing our purchase of War Bonds, too.

WIREMOLD Makers of Textile Webbing and Metal Precision Parts for the Army and Navy.

FLAME DAMPENERS by FRINK

help make 'em that way, Fritz!

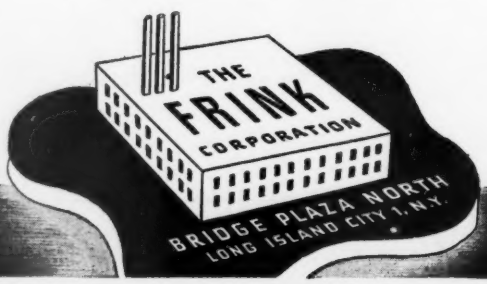
In order to make American fighter planes invisible against night skies, their exhaust manifolds are equipped with flame dampeners. These devices "black out" the exhaust flames and make it nearly impossible for enemy pilots and anti-aircraft gunners to spot our planes in the dark.

Flame dampeners for some of our most potent planes are made to minute tolerances by The Frink Corporation, specialists in the precision manufacturing and engineering that have made the name Frink synonymous with quality and skill in the lighting industry for 86 years.

A pioneer in fluorescent illumination as well as Incandescent lighting, Frink developed LINOLITE, the famous "engineered for vision" Fluorescent equipment now giving such efficient and profitable service in many of America's foremost factories, stores and banks.

Today Frink, together with other leading manufacturers, is heavily engaged in making implements of war. Tomorrow Frink will resume the high quality engineering and manufacturing of lighting equipment which have gained an enviable reputation for its products in the industry.

"LIGHTING SINCE 1857"



Subsidiaries: Sterling Bronze Company, Inc.
Barkon-Frink Tube Lighting Corporation

WAGNER PRODUCTS SPEED VICTORY!

THOROUGH INSULATION

IS ONLY ONE OF THE MANY REASONS WHY

Wagner MOTORS

Stay on the job!

All Wagner motors are built to exacting specifications, and embody characteristics and features that give them long life, dependability and added protection against failure. Wagner engineers will not compromise on "good enough" insulation — all windings must be thoroughly insulated. This is only one of the many reasons why Wagner motors stay on the job.

The illustrations on this page show typical polyphase stator windings. The stator cores of all Wagner polyphase motors are well insulated, using special slot cells formed from tough fibrous material, cuffed on each end for extra strength. The coils and free ends are shaped to fit snugly into the slots so that there is no possibility of vibration and at the same time the windings are easily put into place. Heavy separators are used between the coils in the slot and inverted U-shaped cells fit over the tops of the coils under the slot wedges. The free ends of the windings are completely taped well into the slot cells, and heavy sheets of black varnished muslin are slipped between the coils of the various phases to insulate them from each other.

After the windings are in place, the stator is baked to remove all moisture, and while still hot it is immersed in a heavy insulating varnish. When the heated stator core is immersed in the much cooler varnish a suction is created which produces complete impregnation of the windings. The stator is immersed long enough so that the insulating varnish impregnates the innermost portions of the coils. The stator is then baked again until this coating is completely dried. It is then given another dipping and baking to insure complete impregnation and to provide an added moisture-resisting coating. Finally, the stator is sprayed with air-drying varnish, which not only provides further resistance to oil and moisture, but also gives the coils a glossy surface.

WRITE FOR COMPLETE INFORMATION

Complete information on Wagner motors will be sent upon request. Wagner is a nation-wide organization with branches in twenty-nine principal cities. Each branch office is manned by trained field engineers ready to help you solve your motor-drive problems.

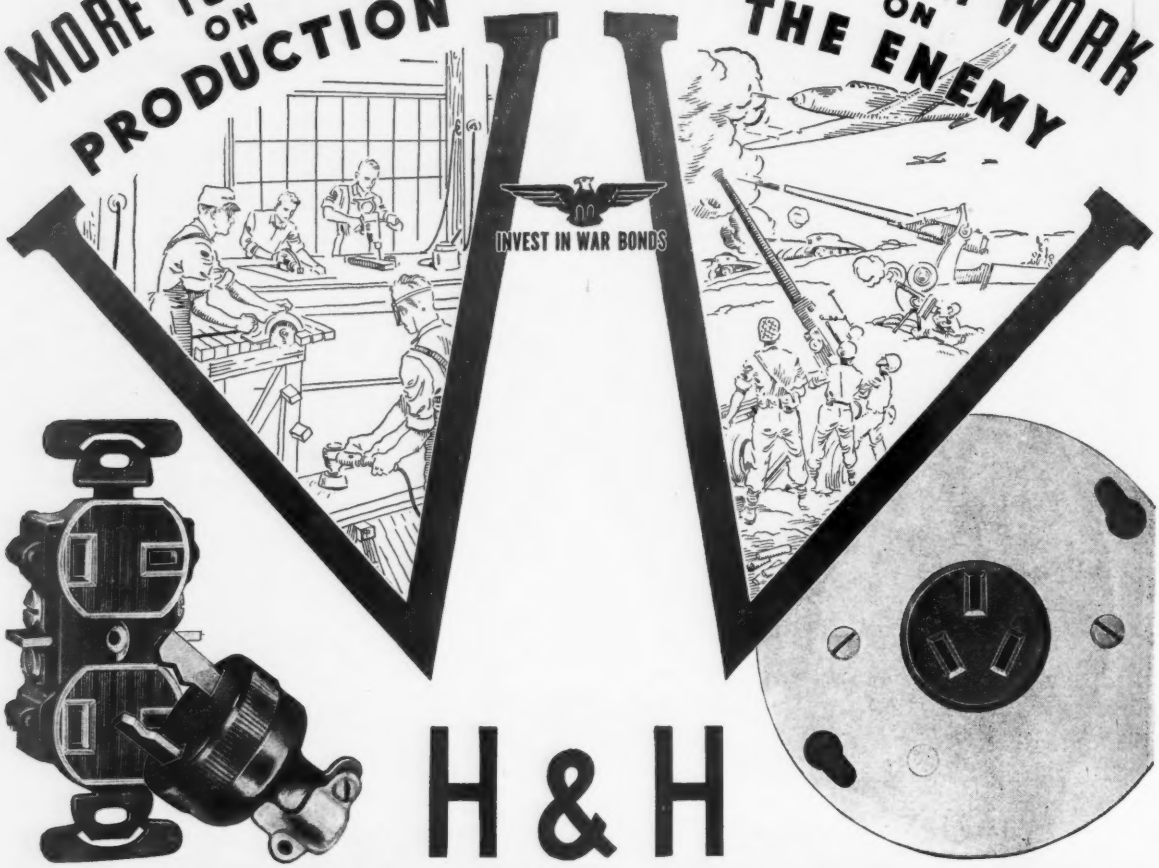
Wagner Electric Corporation
ESTABLISHED 1891
6413 Plymouth Avenue, St. Louis, 14, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

M43-13

UMI

MORE TOOLS AT WORK ON PRODUCTION

MORE GUNS AT WORK ON THE ENEMY



H & H

POLARIZED RECEPTACLES

PLUGS and CONNECTORS

Portable tools give more power to *man*-power on war-production and assembly lines. More electrical *OUTLETS* speed the plant operations which implement *all* operations on the fighting fronts.

H & H provides many preferred types of polarized Receptacles, Plugs and Connectors, — built for rough handling in war-driven manufacturing. Two, three and four-wire devices in 10, 20, 30 and 50 Ampere capacity. The types shown here rank high in dependable service.

HART & HEGEMAN DIVISION

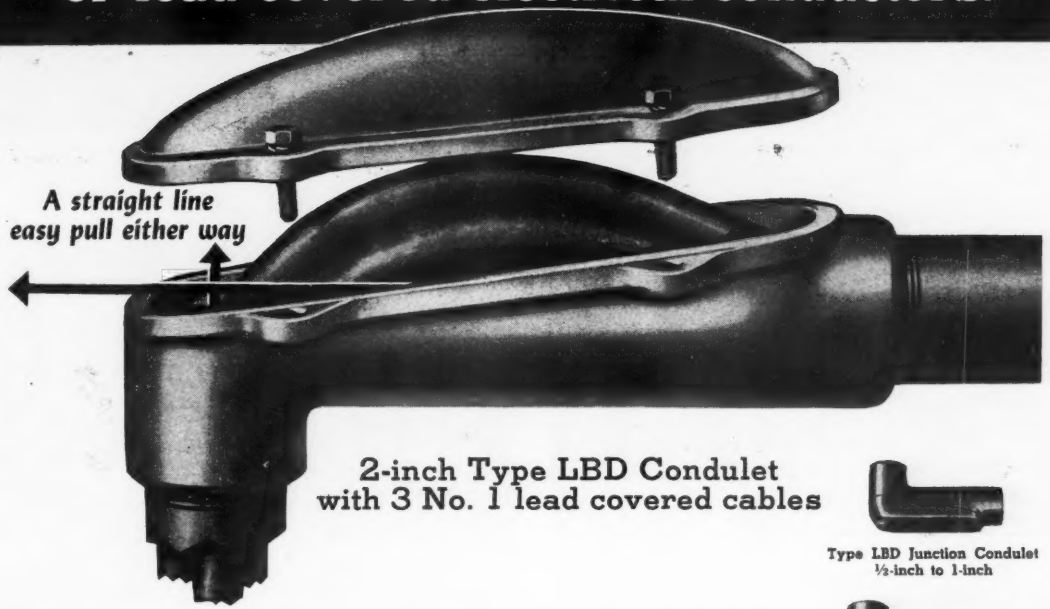
DISTRIBUTED THROUGH ELECTRICAL WHOLESALERS

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U.S.A.

UMI

CROUSE-HINDS

Originator of the **straight line pull** type of junction **Condulet** for large or lead covered electrical conductors.



2-inch Type LBD Condulet
with 3 No. 1 lead covered cables

Type LBD Junction Condulet
½-inch to 1-inch

Type LBD Junction Condulet
1¼-inch to 2-inch

Type LBD Junction Condulet
2½-inch to 6-inch

Type LBH Explosion-Proof and
Dust-tight Junction Condulet
½-inch to 3-inch

- **A straight line pull** through either hub. Saves time.
- **Unobstructed pulling space.** Easy to manipulate conductors.
- **Domed cover.** Provides extra space to prevent sharp bends that are likely to injure conductor insulation or sheath.
- **Gaskets** can be furnished. They make the condulet vaportight and raintight.
- **13 sizes.** For ½-inch to 6-inch conduit.
- An **Explosion-proof** type available. Type LBH in 8 sizes, ½-inch to 3-inch.

CONDULETS, manufactured only by CROUSE-HINDS, are the Standard of Quality in the field of electrical conduit fittings.

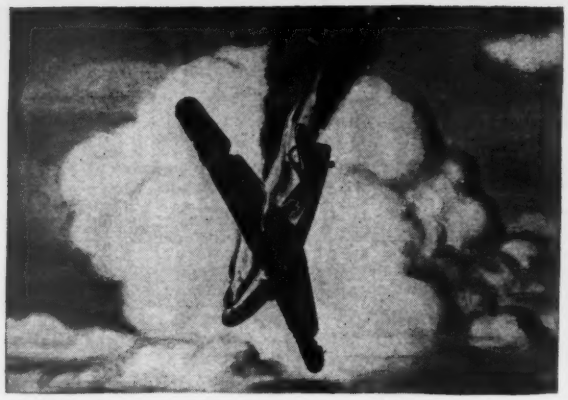
A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY
SYRACUSE, N. Y., U.S.A.

Offices: Birmingham — Boston — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — San Francisco — Seattle — St. Louis — Washington

Resident Product Engineers: Albany — Atlanta — Charlotte — New Orleans

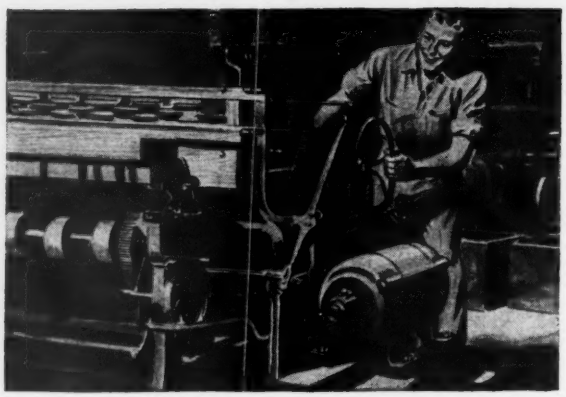
CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.



1. Mounting enemy plane crack-ups result from . . .

2. . . . the superior equipment and shooting ability of American pilots.

3. One equipment requirement is an ample supply of strong, well-made ammunition belts to feed the bullets through the guns.



4. To meet this demand, looms for weaving the belts were speeded up and the motors operating the looms were frequently overloaded.

What one man and 40 loom-motors did about it

To quote from the Plant Superintendent's letter:

"Early in 1942, we installed 40 new narrow-fabric looms, individually driven by glass-wound motors . . .

"Since the installation of the looms, we have overloaded them to step up production, but this has had no adverse effect on the motors whatever. We are very pleased with their performance, and they certainly are neat and compact. Believe me, all motors purchased for my division will be glass-wound motors in the future." (1)

The glass in these motors is Fiberglas* Electrical Insulation.

This insulation can withstand frequent overloading . . . just one of the reasons why design engineers, plant superintendents, and maintenance men are using increasing amounts of Fiberglas for important wartime applications.

They are using the low space factor of Fiberglas to make smaller, lighter, more compact equipment. They are skillfully combining it with suitable impregnants to take advantage of its great resistance to moisture, acids, corrosive vapors, and other causes of insulation breakdowns.

Used by Services

The Army and Navy have also recognized these qualities of Fiberglas and are finding increasing uses for it in the important fighting equipment—from battle ships to airplanes.

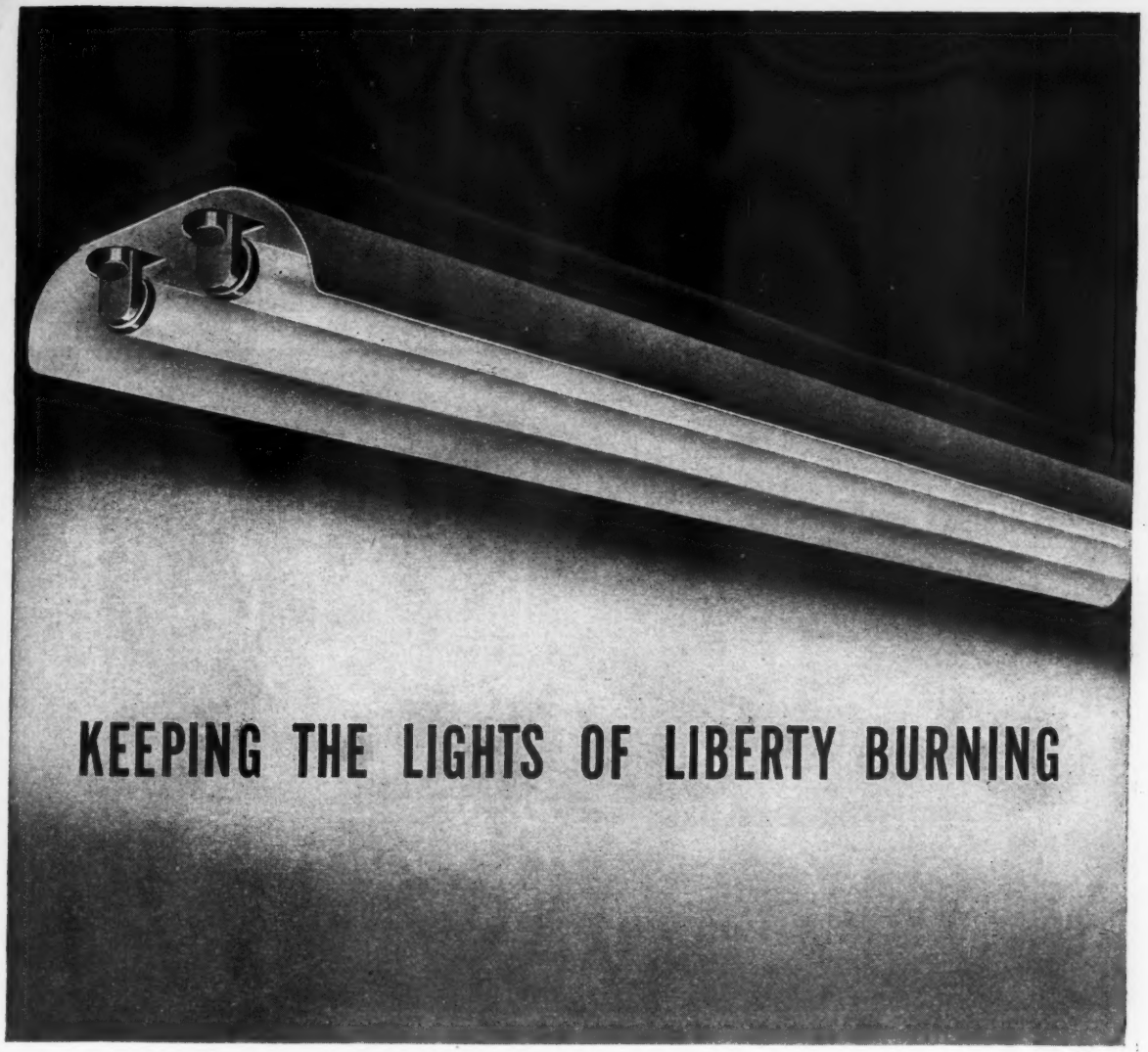
Since these vital Army and Navy requirements come first, even the constantly increasing production of Fiberglas electrical insulation is sometimes strained. But there is still enough to take care of those jobs where Fiberglas is the only suitable material.

Ask your electrical distributor for technical data on Fiberglas and its availability for your war use. Or write: *Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

FIBERGLAS
*T. M. Reg. U.S. Pat. Off.

ELECTRICAL INSULATIONS

(1) Name on request.



KEEPING THE LIGHTS OF LIBERTY BURNING

THANKS to the foresight and creative skill of the fluorescent lighting industry, huge war plants today are being flooded with soft, non-glaring light at a high level of illumination . . . at the same time, very critically needed steel is being saved for ships, tanks and guns.

The new non-metallic reflector shapes, now being widely used in industrial lighting equipment, represent months of research and development on the part of a group of men who were determined to find a suitable replacement for steel in the manufacture of vitally needed fixture reflectors.

The Masonite Corporation is glad it has been able to work with the lighting industry in this crisis . . . by developing a special reflector shape which many have found offers definite advantages for war plant lighting.

Light-weight, durable and water-resistant, the new Masonite* Reflector Shape cuts shipping costs, makes installations easier . . . is a non-conductor . . . takes fine reflecting finishes . . . withstands hard usage. For more information, write Masonite Corporation, 111 West Washington St., Chicago, Illinois.

MASONITE CORPORATION

*TRADE-MARK REG. U. S. PAT. OFF. "MASONITE" IDENTIFIES ALL PRODUCTS MARKETED BY MASONITE CORPORATION. COPYRIGHT 1943, MASONITE CORP.

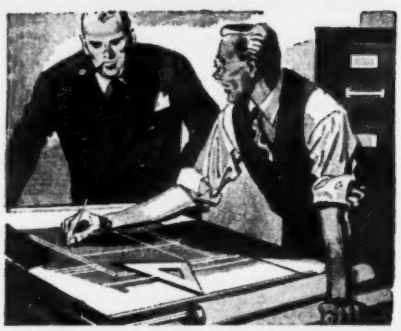
YESTERDAY

Going up! When gay, young blades went calling, the touch of a little button brought swift, convenient service. It was just one of thousands of Edwards signaling devices serving peacetime, social and business communication needs of the country.

TODAY

Going down! Another signal. But now his touch deals out death to the enemy . . . timed to the split second. Again, it is an Edwards signal, one of thousands of high-speed communications systems serving the United Nations.

TOMORROW? Better communications for peacetime industry



• First things first! Right now Edwards equipment is the hair-trigger "nerve center" in many implements of war . . . the "voice" of armies, air fleets and naval squadrons. That's *first*.

But the beginning of another era is ahead of us . . . one which will be built upon—strengthened with—the research of war-trained industries. A time when business men will take war developments and convert them into better peacetime products.

Edwards proposes to be first in the communications field, in converting its war-born and war-tested products and ideas.

Edwards is already at work . . . preparing . . . so that America's factories, institutions, homes and public utilities will have the most advanced signaling devices and communications equipment for peacetime services and projects.

Edwards and Company, Norwalk, Conn.
In Canada, Edwards and Company, Ltd.

EDWARDS
SINCE 1872
Communication Equipment for Homes, Institutions and Industry

MITCHELITE

GREATER FLEXIBILITY

than ever before in Fluorescent Fixtures for War Industry

Provides for Every Method of Mounting and Hanging

The New MITCHELITE Design is amazingly simple and flexible. It can be used for every type of installation in factory, office or drafting room. Wide range of low-cost accessories and fittings, designed to save time installing and servicing, provide for every conceivable method of mounting or hanging. FOUR "LIGHTWEIGHT" MODELS —2-light and 3-light units using 40-watt lamps—a 2-light unit using 100-watt lamps —and a 2-section unit for four 100-watt lamps. Each model can be used for both individual and continuous row lighting, for surface or suspension mounting.

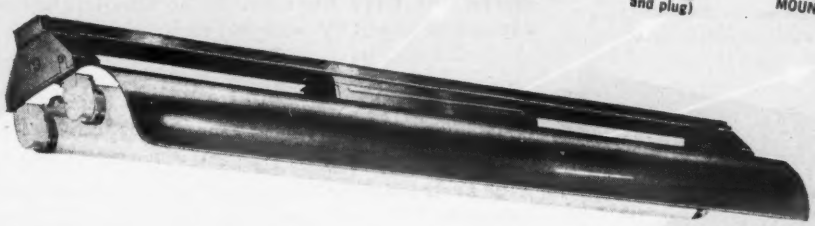
CHAIN SUSPENSION (with Flexible cable)

LEVOLIER SWITCH (with pull chain)

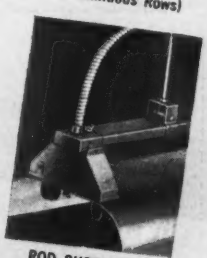
CHAIN SUSPENSION (with cord and plug)

CONDUIT STEM MOUNTING

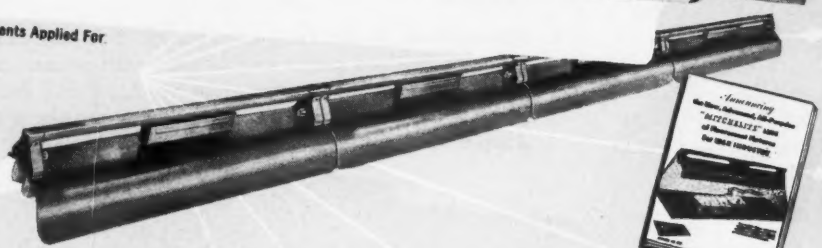
SURFACE MOUNTING (Continuous Rows)

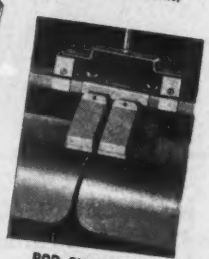


Patents Applied For



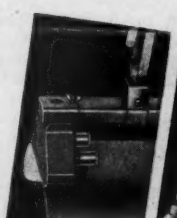
ROD SUSPENSION (Individual Unit)





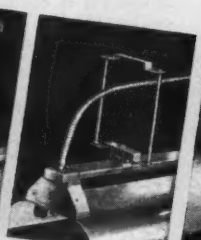
ROD SUSPENSION (Continuous Rows)

FREE illustrated MITCHELITE CATALOG NO. 400 gives complete details. Send for it now.



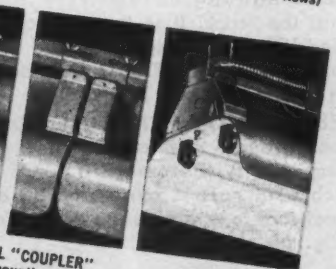
MESSENGER CABLE with Special Cable Hanger

I. P. STEM MOUNTING WITH CANOPY



ALIGNER STRAP AND RODS

WIREWAY CHANNEL "COUPLER" for continuous row mounting. Units securely connected with easy-fit "Coupler"



SURFACE MOUNTING (Individual Unit)

MITCHELL FLUORESCENT

MITCHELL *Manufacturing Co., 2525 Clybourn Ave., Chicago*

FOSTORIA HAS 3 *Vitally Important* ADVANTAGES IN FLUORESCENT LIGHTING EQUIPMENT . .

—Unequaled OPERATING EFFICIENCY

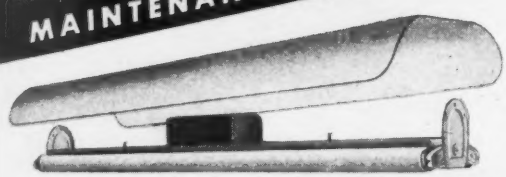
Full Light Instantaneously. Turns on and off like an incandescent lamp.

No Blinking when lamp life nears end. Gives full light service until lamp fails completely.

Low Voltage Operation. Operation continues even though voltages drop below 50 when line voltage is not controlled.

98% Power Factor at 118 volts. Connected for stroboscopic effects.

—Unequaled MAINTENANCE ECONOMY

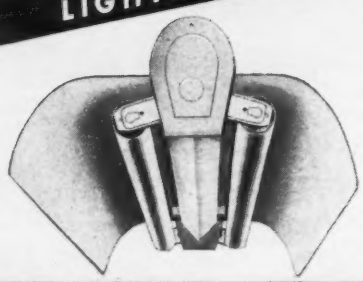


No Starting Switches Necessary. Saves time and expense of replacements.

Reflectors Removable from Top. No interruption of lamp operation when cleaning reflectors.

Wired for Easy Service. Removal of reflector exposes wiring in "V" channel to full view.

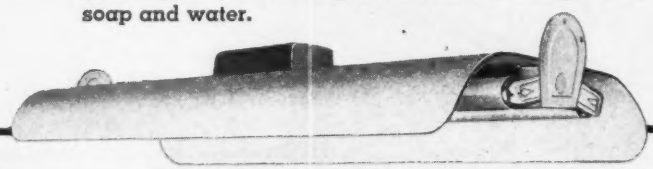
—Unequaled LIGHTING OUTPUT



Eliminates Light Absorption between Lamps. "V" channel separates the two lamps—adds to reflection value.

High Lumen Output. Equivalent to any commercially available 2 lamp 40 watt unit.

Unexcelled Reflecting Efficiency. Non-metallic reflector finished inside and outside with permanent gloss white synthetic enamel baked hard and mar-proof by near infrared process. Cleans easily with soap and water.



MODEL MF-240-N. Designed to accommodate two 40 watt fluorescent lamps mounted on 5 inch centers. Individual or continuous row installation. Mounting by ceiling bracket, or suspension from chains, messenger cable or clevis and conduit.

A MODERN INDUSTRIAL TOOL

Critical work areas in industry need a combination of two distinct types of lighting, (1) good LOCALIZED lighting of relatively high levels directly on the work. It is impractical to obtain this needed 100 to 300 footcandles and over in any other way. (2) Good GENERAL lighting for work area surroundings.

LOCALIZED AND GENERAL lighting applied in the proper proportions, usually in the ratio of 5 to 1 respectively, become BALANCED LIGHTING which is at once a more efficient and more economical tool to enhance the worker's productive ability.

BALANCED LIGHTING

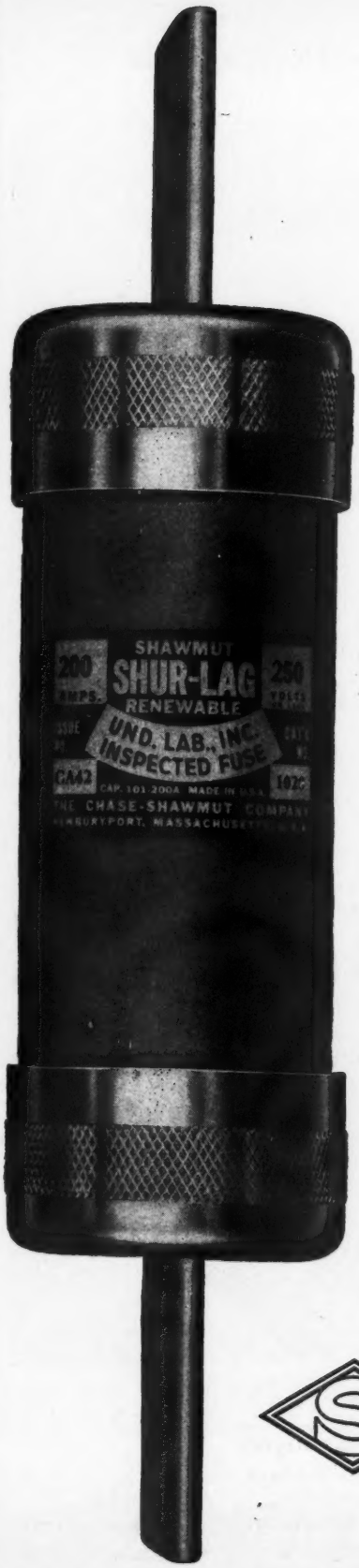
GENERALITE fostoria for Overall Lighting

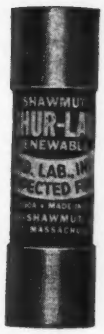
LOCALITE fostoria for Light ON the Job

for Better Seeing in Industry

THE FOSTORIA PRESSED STEEL CORPORATION, Fostoria, Ohio

In Canada—Write Amalgamated Electric Corp., Ltd., Toronto





FIFTY YEARS

OF QUALITY IN THE

MANUFACTURE OF

ELECTRICAL EQUIPMENT

FOR CIRCUIT PROTECTION

★ 1893-1943 ★

SHAWMUT IS

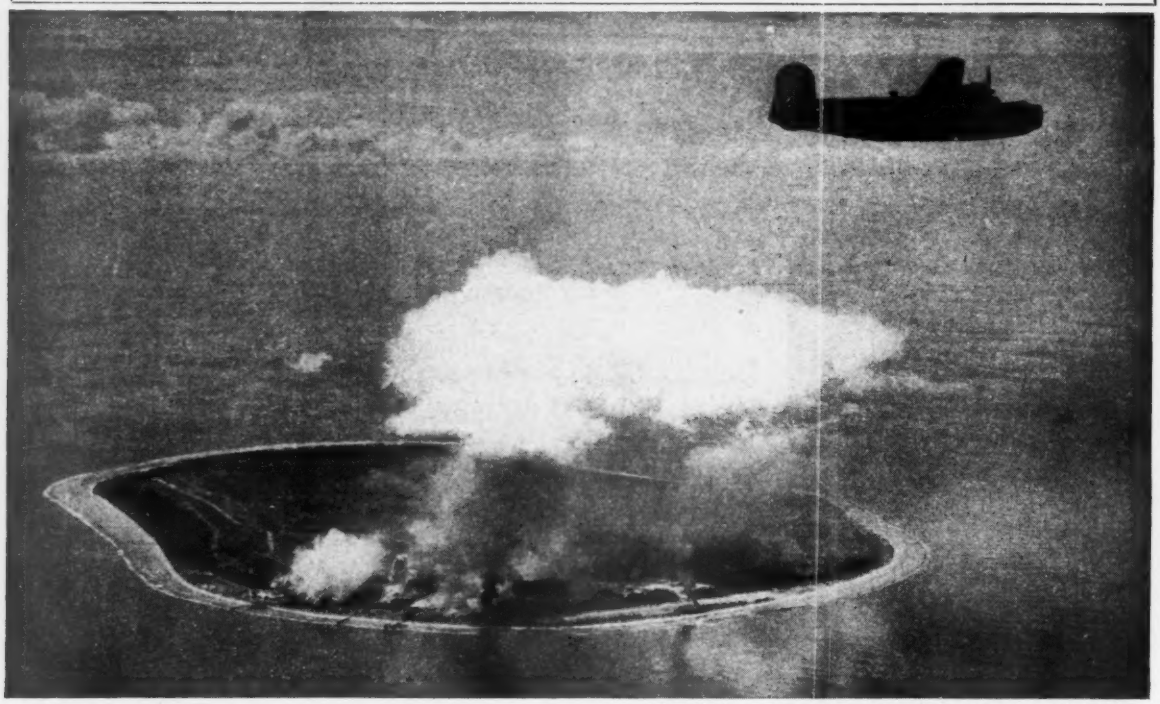
THE WORD

FOR FUSES

THE CHASE-SHAWMUT COMPANY

NEWBURYPORT, MASSACHUSETTS

U. S. Bombers Set Fires at a Japanese Pacific Base



Herald Tribune—Acme (telephoto) from United States Army 7th Air Force.

Smoke rising from shore installations and the phosphate works on Japanese-held island, somewhere northwest of Guadalcanal, during raid by Liberator bombers, one of which appears at the upper right of photograph.

BEHIND TODAY'S HEADLINES!

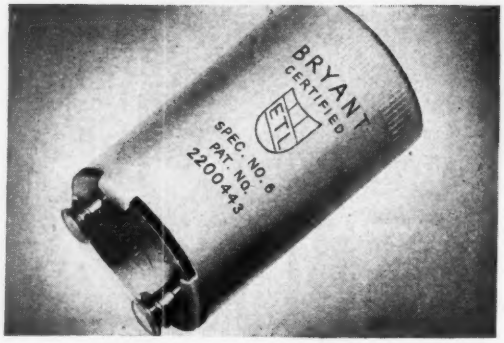
Today—as never before—*fighting* production must stand squarely back of America's fighting men.

Behind every headline there is a clear-cut indication of the need for more and more planes, guns, ammunition!

In this war of materials, the Bryant Electric Company is contributing its full facilities, providing electrical devices for new factories, helping re-build and modernize older installations.

Typical of the items supplied is Bryant Fluorescent Starter FS2, 15-20 Watt; FS4, 30-40 Watt; FS6, 100 Watt.

Bryant Starters provide proper pre-heat for lamp starting. Lamps last longer. There is less blackening. You obtain more dependable starts in cold weather and have less trouble at low voltage.



BRYANT
SUPERIOR WIRING DEVICES

Now more than ever... every outlet deserves a reliable Bryant device. Sold through electrical wholesalers.

THE BRYANT ELECTRIC COMPANY • BRIDGEPORT, CONNECTICUT

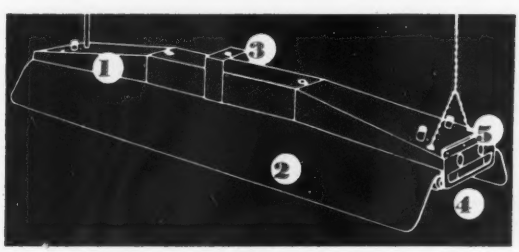
NEW YORK • SAN FRANCISCO CHICAGO • LOS ANGELES

The Latest and Best IN FLUORESCENT LIGHTING!

EFFICIENT! SIMPLE! PRACTICAL! ATTRACTIVE! EASY-TO-CLEAN!

1 Ingeniously engineered Accessory Housing—long—lean—good looking—and tough! Meets W. P. B. metal limitations. Die-formed from a single piece of steel.

2 Masonite "REFLECTOR-BOARD" Reflectors; formed in our plant, rigidly checked, quality controlled. Finished "300° White" (88% R. F.). Reflector easily removed and reinstalled, with "Flexible Triggers."



3 Hang it anywhere—anyway! K.O.'s for conduit and chain. Sliding hanger for outlet spacing variations.

4 Supports for Eggcrate Louvres, when desired. Louvres can be attached to standard units, initially or at later date.

5 "Bump-Proof" end-plates give added lampholder protection. Starters easily accessible even when SUPER-ILLUMINATORS are mounted directly at ceiling.

For full details on the GUTH Super-Illuminator, Write for Catalog Sheet No. 744.

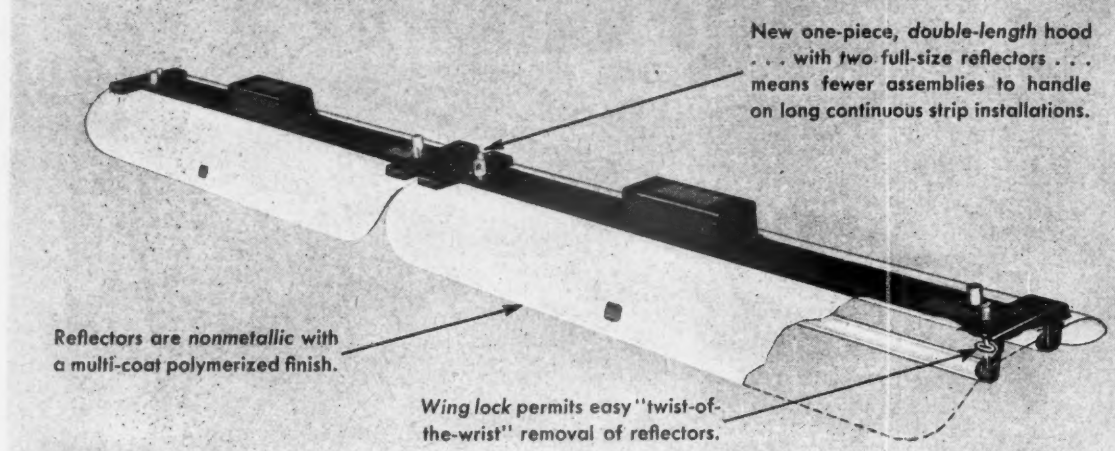
★ ★ ★ ★ ★ ★ ★ ★

Leaders in Lighting Since 1902 **Guth**

★ ★ ★ ★ ★ ★ ★ ★

THE EDWIN F. GUTH CO. • 2615 Washington Ave. • St. Louis, Mo.

BUILT For Easier CONTINUOUS STRIP Installation


New one-piece, *double-length* hood . . . with *two* full-size reflectors . . . means fewer assemblies to handle on long continuous strip installations.
Reflectors are *nonmetallic* with a multi-coat polymerized finish.
Wing lock permits easy "twist-of-the-wrist" removal of reflectors.

A New *LIGHT-WEIGHT* Luminaire For War Production Illumination

Westinghouse Continuous Strip Fluorescent Lighting can now be installed *quickly,* and *economically,* to help speed production of vital war materials. With this new Double-Reflector Luminaire, the only one of its kind on the market today, installation costs are considerably reduced—because you have fewer assemblies to handle.

This luminaire comes to you completely assembled, and is the equivalent of *two* conventional Fluorescent Units. The hood (or chassis) is of one-piece, all steel construction. While conforming with General Limitation Order L-78, it is rigidly built—capable of supporting a weight of 125 pounds at any point. New sliding hangers permit suspension from any part of the hood.

The moisture-resistant, nonmetallic reflectors are covered with a multi-coat, polymerized finish which provides a reflection factor of 85% or more. And it requires only a "twist of the wrist" to remove a reflector for cleaning. The ballast, now externally mounted, provides a power factor ranging from 92 to 99%.

Westinghouse Double-Reflector Continuous Strip Luminaires are available for use with four or six 40-watt (or four 100-watt) Mazda F Lamps. Any one of 117 Westinghouse Electric Supply Company Offices or Independent Westinghouse Lighting Distributors will give you full details regarding these luminaires and their installation. Or you can write Westinghouse Electric & Mfg. Company, Edgewater Park, Cleveland, Ohio.

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE
Lighting Equipment

GREAT NAMES in American Progress

ROBERT FULTON, BOAT BUILDER — On a fateful Friday in 1807, a skeptical crowd gathered at the foot of Cortlandt Street, New York. They came to watch "Fulton's Folly" attempt the "impossible" by traveling without sails from New York to Albany. Those who came to jeer stayed to cheer. "Crazy" Bob's puffing, snorting Clermont wheezed away from the jetty and grunted upstream against the wind at the miraculous speed of four miles an hour. On that day, Robert Fulton, well-nigh penniless dreamer, revolutionized the water-borne transportation of the world.

AMERICAN BLOWER

American Blower products have contributed much towards the progress of American industry — progress that today is making it possible for America's vital industries to outproduce the world. In the great public utilities, the steel industry, in the manufacture of petroleum products, chemicals, in food processing, mining, smelting and refining, in hospitals, schools, public buildings and homes, American Blower air handling equipment has kept pace with progress.

Utility Set

CONTRACTORS—DEALERS— We're working 100% for victory. But you can still buy American Blower products for vital war work. After victory we'll be ready with the most complete line of heating, ventilating and air handling equipment in history.

ARMY E NAVY

For excellence in production

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator and Standard Sanitary Corporation

To locate *new sources of supply*

You're in a jam—an old supplier (through no fault of his own) can't deliver. Who else can you turn to? What new sources of supply are available? Pick up your 1943 E-B-R (Electrical Buyers Reference), flip to the helpful Directory of Manufacturers on Page 393—check the listing of the product you're seeking. There are your suppliers—and the ones listed in bold face give you further specifying data in the 369 page BRIEFALOG* section. Yes, it's as *easy* as that!

** E-B-R's own original version of modern condensed cataloging.*

IF IT'S ELECTRICAL ...LOOK IT UP FIRST IN E-B-R

Now more complete than ever before, your 1943 Electrical Buyers Reference gives you:

MANUFACTURERS BRIEFALOG SECTION—Condensed catalogs of 290 manufacturers. Product specifications, branch offices, warehouses, etc.

CLASSIFIED DIRECTORY—Company addresses and trade names, arranged by product. Extensive cross-references to help you find the electrical and allied products made by more than 3,500 manufacturers.

INDEX OF TRADE & COMPANY NAMES—Complete with addresses. Starting with only a trade name or a company name, you can thus quickly locate the product data you need.

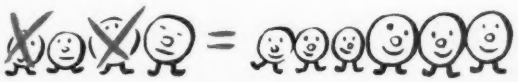
A WORD OF EXPLANATION—E-B-R is not sold, and is not offered as a premium for subscriptions to any magazine. It is distributed to a limited number of men directly responsible for the specifying or requisitioning of substantial amounts of electrical materials.

McGRAW-HILL PUBLISHING COMPANY, 330 W. 42nd ST., NEW YORK 18, N. Y.

"Dear Uncle Sam: What do I do now?"

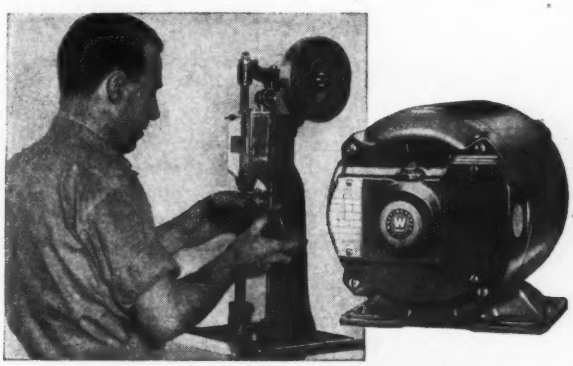
Cheer up, sir! Uncle Sam has taken steps to provide for your sole!

High priorities are now provided by WPB for small motors to drive shoe repair machinery. This conserves leather . . . makes your shoe coupons go further.

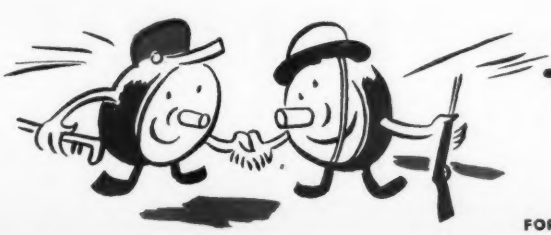


In co-operation with this policy, Westinghouse, by simplifying and reducing the number of ratings manufactured, is making available thousands of small motors for essential home requirements. Motors for shoe-soling machines are just one example. Others include small motors for milking machines, stokers, portable power tools, pumps and fans for heating and ventilating.

Although the fighting front continues to demand most of the greatly enlarged facilities of the Westinghouse Small Motors plant, small motors are now available for vital, home front use. So for motors on any front—war or home—consult Westinghouse. J-03192



The Auto-Soler, an automatic soling and heeling machine, helps meet the expanded demand for shoe repair. To drive it, Westinghouse is supplying a type FH split-phase motor—(¾ horsepower).

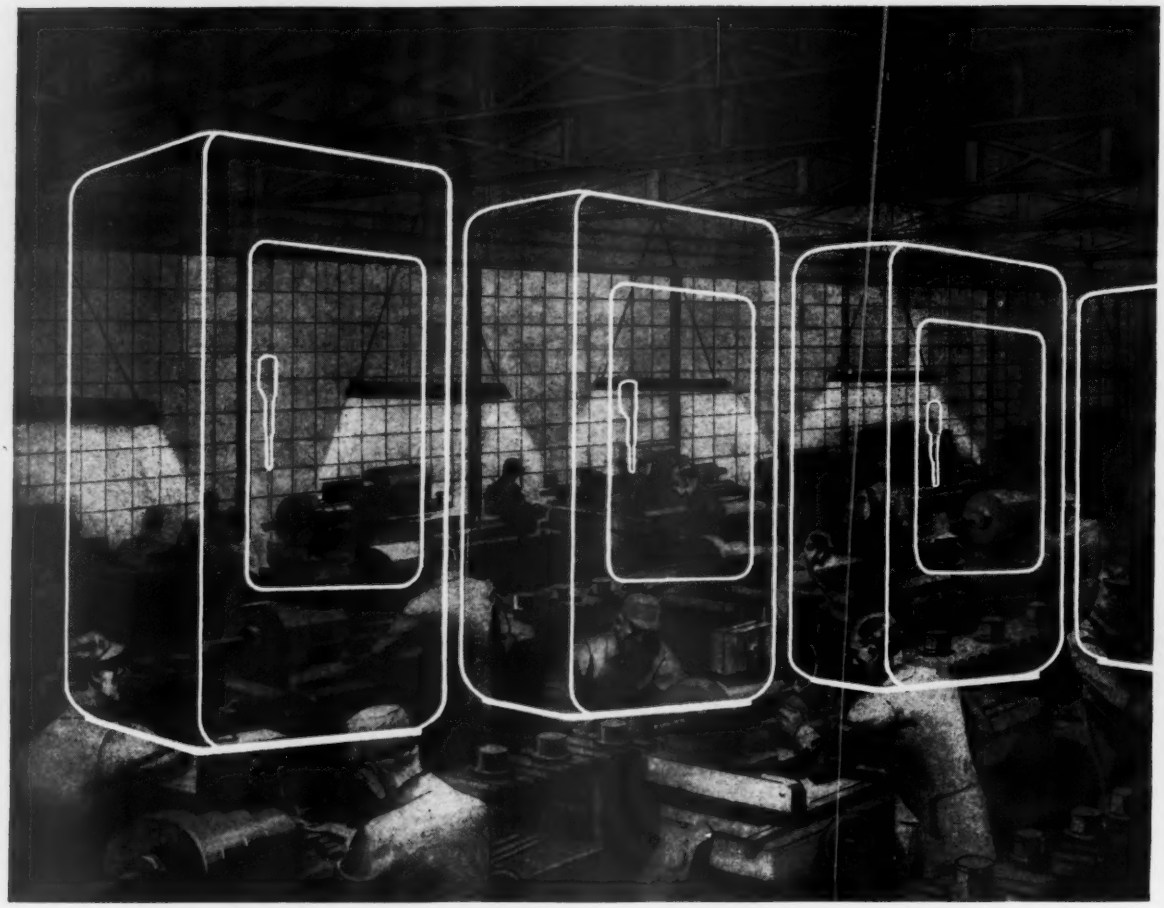


Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

small motors

FOR ESSENTIAL NEEDS ON BOTH WAR FRONT AND HOME FRONT



P-A-X Will Continue to Speed Production

. . . when Refrigerators Replace Machine Guns

In scores of plants engaged in full-time production of material and equipment for the Armed Forces, P-A-X automatic telephones are today helping to get things done faster —eliminate delays and errors in the all-out drive for Victory.

And for the Armed Forces, too—at fighting bases, supply depots and training camps P-A-X is providing swift dependable communication — getting faster action, better coordination.

ELECTRICAL CONTRACTORS IMPORTANT!

Today, new P-A-X equipment and other Automatic Electric intercommunication systems must be reserved for the fighting forces.

But "tomorrow," when conveyor lines are jammed with refrigerators instead of machine guns—new and better Automatic Electric equipment will be available to help *every* business reduce costs and errors, save time and motion, coordinate the efforts of men and machines.

HERE IS HOW P-A-X IS HELPING TO SPEED WAR PRODUCTION

- Saves time for all employees
- Stops walking and "visiting"
- Reduces errors and delays
- Gets and gives vital information quickly
- Improves executive supervision
- Co-ordinates work of all departments

AUTOMATIC ELECTRIC

PRIVATE INTERIOR TELEPHONE SYSTEMS

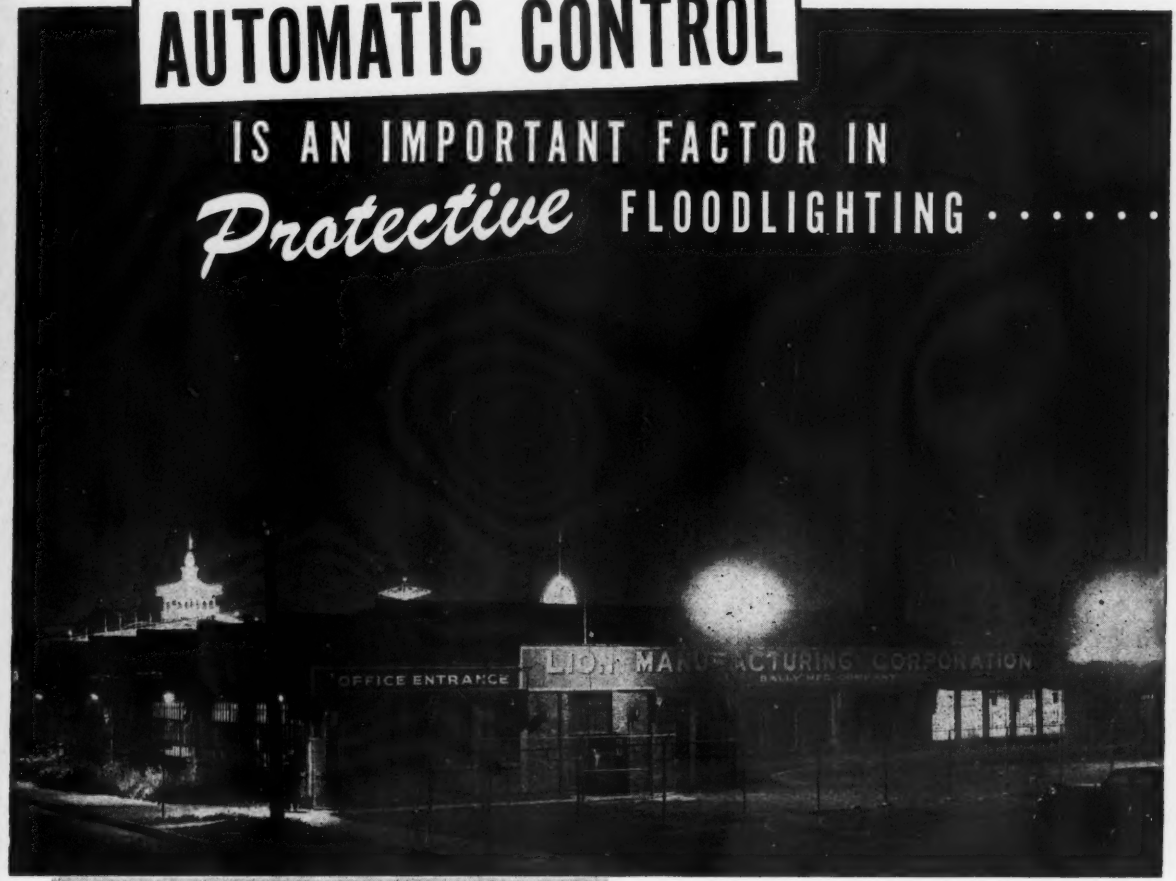
Distributed by: **Automatic Electric Sales Corporation, 1033 W. Van Buren Street, Chicago, Ill.**

Sales and Service Offices in Principal Cities

In Canada: **Automatic Electric (Canada) Limited, Toronto**

AUTOMATIC CONTROL

IS AN IMPORTANT FACTOR IN *Protective* FLOODLIGHTING · · · · · ·



THERE'S THE EXACT TYPE OF SANGAMO TIME SWITCH FOR ANY SPECIFIC REQUIREMENT

In the Sangamo line are Astronomic Dial Synchronous Carry-over, and Outdoor Time Switches.

DURING BLACKOUTS

During any current interruptions, as for instance when a master switch is pulled for a temporary blackout, Form VSWZ Astronomic Dial Time Switch will continue to run for ten hours. An automatic carry-over feature provides for clock-spring operation when the current is off. The clock-spring rewinds automatically when the current is restored, and the time switch resumes its normal synchronous operation.

★ Full automatic control of protective lighting provided by Sangamo Time Switches is a guarantee that the on and off time of lights will be exact to the minute. Vital property serving in war production can't afford to take chances on lights dimming at the wrong time. Sangamo Time Switches are logical for these types of installations. A catalog showing all the Sangamo types of Time Switches and telling of the many purposes for which each is suited is available.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

This Emerson-Electric 300 Amp. Portable A. C. Arc Welder has a service record of 6000 production hours without maintenance expense. Photographed on the job.

"6000 Hours on the Production Line"

Emerson-Electric Portable A. C. Arc Welders Are Built for Rugged, Dependable Service

The standards which have characterized Emerson-Electric Products for the past 53 years are piling up newsworthy performance records for Emerson-Electric Portable A. C. Arc Welders in hundreds of war plants and repair shops.

Four Sizes—Six Types. Welding Range 20-300 Amp. Approved by Underwriter's Laboratories.

Available on priority ratings. Write for prices, specifications and performance data.

THE EMERSON ELECTRIC MANUFACTURING CO.
ST. LOUIS • *Branches:* New York • Detroit • Chicago • Los Angeles • Davenport

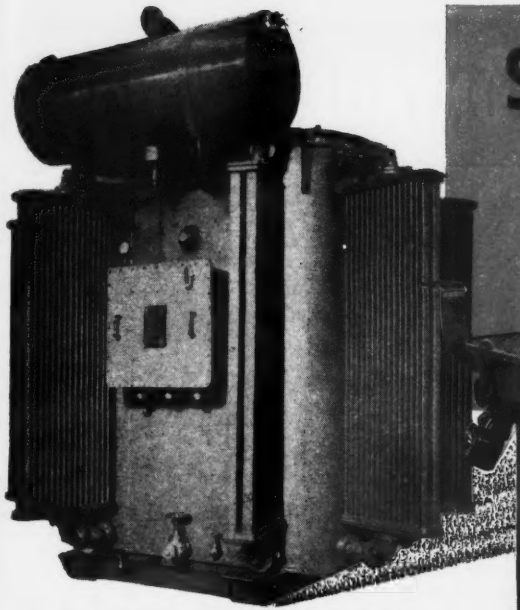
Emerson-Electric is now engaged 100 percent in the production of equipment for war and war plant use. In addition to regular products are power-operated airplane gun turrets and electric motors for aircraft.

329

EMERSON ELECTRIC

MOTORS • FANS • APPLIANCES • A. C. ARC WELDERS

SPECIALIZATION
is the basis of
AMERTRAN Performance



AmerTran Transformer. 5000 KVA, 3-phase, 60 cycles. 13,800 high voltage, 2400/4160Y low voltage.

AmerTran Outdoor Current Transformer. 30 VA. 30 Amperes primary—5 Amperes secondary. 11,400-Y volts service.

AmerTran Transformer for pole mounting. 15 KVA. 2400/4160Y high voltage. 120/240 low voltage.

AmerTran Abestol Distribution Transformer. 150 KVA, single phase. 600 high voltage. 240/120 low voltage.

Making *only* transformers and their related products for forty-two years has meant giving continued satisfaction—gaining increased knowledge in the process—and giving, again, in improved AmerTran products.

In these years of specialization, we have learned how to build AmerTran Transformers sturdy and long-lasting. The unusual life record of AmerTran Transformers has been effected simultaneously with a constant increase in efficiency, by the proper coordination of materials at the disposal of our engineers.

And we have obtained a broad knowledge of transformer applications as well. The outgrowth of that knowledge is a host of special AmerTran applications. The test sets, renowned for their precision—the voltage regulators with their smooth control through 100% range, if desired—and others.

One of the great lessons of these years is that we fare best by maintaining AmerTran rigid standards of quality workmanship.

AMERICAN TRANSFORMER COMPANY
178 Emmet Street **Newark, N. J.**

AMERTRAN

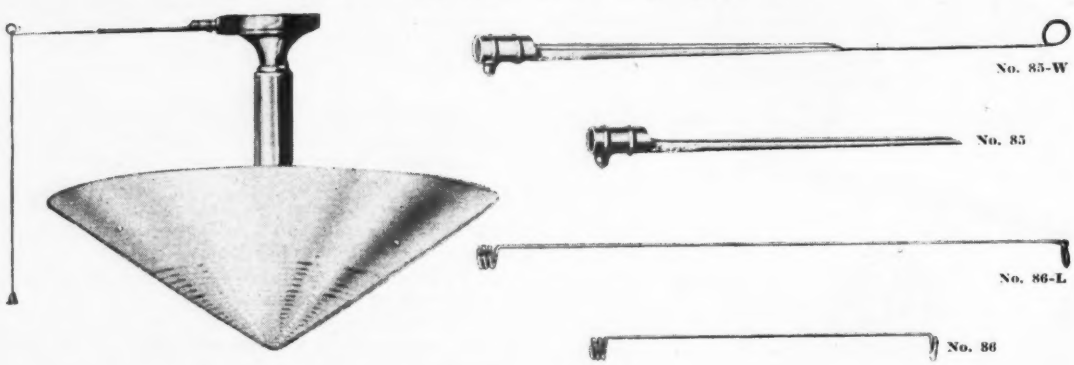
Levolier INDIVIDUAL CONTROL SWITCHES

No. 41 No. 1010 No. 41-B

McGILL individual control Levolier switches are vital factors in the conservation of electric power. Trouble-free operation is assured in every type of installation. They are simple to install and afford a big saving in wire, conduit and labor.

Nos. 41 and 41-B are 6-amp., 125 volt, "T" rating, ideal for fractional H. P. or individual light control. 41-B has a plastic shell casing. No. 1010 is 10-amp., 125 volt, "T" rating, lever controlled for high watt and high intensity lamps, as well as fluorescent installations. This Levolier Switch is capable of taking an initial surge of 80 amps., or eight times its rated capacity. Also has a new plastic shell casing.

EXTENSION ARMS



Repeated pulling of lamp cords that rub against reflectors, shades and bowls, causes needless wear, expense, swaying and broken fixtures, risks and repairs. McGILL Extension Arms eliminate all this hazard. Nos. 85 and 85-W are designed to fit any regular brass lever Levolier switch. No. 85 can be extended for use with 18" and 22" and larger basin fixtures. Tubular formed for rigidity.

Nos. 86 and 86-L are designed to fit the smaller, new style steel lever of No. 41-B plastic shell switch. Any one of these Extension Arms are easily installed and last indefinitely.

ELECTRICAL DIVISION

McGILL MANUFACTURING COMPANY, INC.
VALPARAISO, INDIANA

AS RECENTLY ANNOUNCED, *we are now building "Megger" instruments in this country, and are in production on the popular "Meg" and "Super-Meg" types. The acceptance accorded these new all-U. S.-made instruments has added to our already large backlog of orders, which we are now filling as rapidly as possible. Your orders for "Megger" instruments will be accepted according to priority ratings and with our assurance that delivery will follow as quickly as our further-expanding facilities will permit.*

FORESTALL electrical breakdowns... WITH THE "MEGGER" TESTER!

Now, more than ever, it is vital to hold electrical failures to a minimum. Periodic testing of the insulation of motors, generators, cables, signal-control and other electrical apparatus can save priceless time and protect irreplaceable equipment. Testing with a "Megger" instrument is only a matter of minutes, but it can reveal potential damage and save days of costly delay.

"Megger" insulation testers are completely self-contained—wholly independent of batteries. Simply connect to the equipment under test, turn the hand cranked generator and read insulation resistance directly by the pointer over the scale. Over 40 years of service in industry has proved the value of "Megger" Practice.

Write for any or all of the bulletins listed and a free copy of the Pocket Manual of "Megger" Practice, No. 1420-EC.

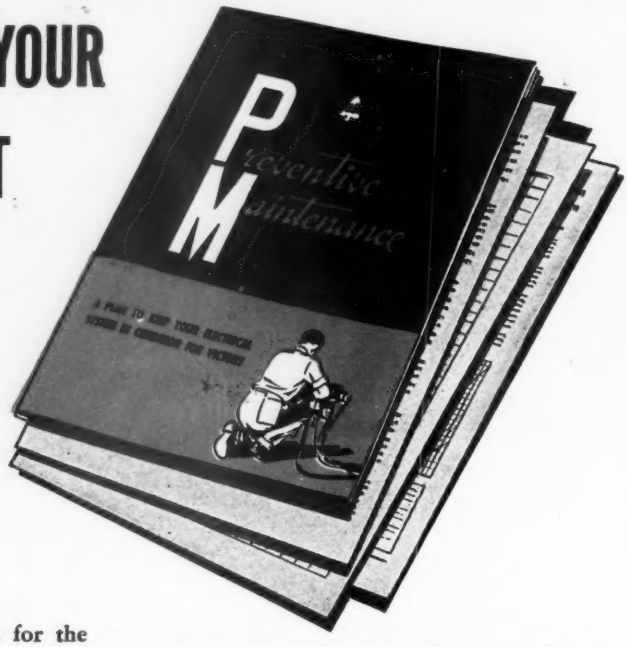
BIDDLE BULLETINS

- Use of Hand-driven "Megger" Tester, Bulletin 1655-EC.
- How to Test Insulation and Avoid Trouble in Electrical Equipment, Bulletin 1640-EC.
- Various types of "Megger" Insulation Testers, Catalog 1685-EC.
- Bulletin 1735-EC on the New U. S.-made "Megger" Insulation Tester in plastic molded case.

JAMES G. BIDDLE CO. · 1211-13 ARCH STREET · PHILADELPHIA 7, PENNA.

HERE'S HELP ON YOUR MOST IMPORTANT WAR JOB

-the PM plan simplifies industrial plant maintenance



With construction cut to a minimum for the duration, maintenance of industrial electrical equipment is the contractor's most important war job. By such a program, he has a direct hand in helping industry maintain continuous wartime production—despite shortages in essential wartime equipment.

Based on an annual maintenance agreement, contractors can offer: regular and systematic inspection and repair; service by specialists on electrical problems; broad experience gained over a period of years, in many plants; up-to-date methods and materials; proper tools and equipment, to do a thorough job.

To aid contractors in this vital activity is Anaconda's aim. With this in view, the Preventive Maintenance Plan was designed. Although introduced only recently, over 12,000 free Plan Manuals have already been sent out on request.

WHAT THE PLAN IS

The PM plan is a simple but comprehensive guide which can help you maintain electric wire and cables in busy war plants and thus help safeguard continuous peak production.

HOW IT WORKS

The plan provides a practical means of making a periodic, systematic analysis of circuits and equipment. Uncovers potential weaknesses . . . suggests ways to correct them . . . prevents overloading of lines.

Data thus gathered aids local W.P.B. Branches in reaching decisions on requests for materials to *prevent* accidents.

NOTE: Your Anaconda Distributor will gladly cooperate in working out the program.

HOW THE CONTRACTOR BENEFITS

The PM plan assists in carrying out the all-important maintenance program. Helps keep business going and trained personnel together during construction lull . . . enables contractors to put employees on an annual, rather than hourly, wage rate . . . helps keep old customers, gain new ones, despite lack of products to sell . . . puts electrical contractor in leadership role for furthering the war effort.

If you aren't already utilizing the Anaconda Preventive Maintenance Plan, mail the coupon for full details.

43237B

"Tomorrow may be too late . . . do it today!"

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

Anaconda Wire & Cable Company
25 Broadway, New York City 4

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding wartime production.

Individual .....

Company .....

Address ..... City .....

EF

UMI

Aviation—A Progress Report

The Lessons of War Become the Key to a Richer Peace

TUNISIA, PANTELLERIA, SICILY—stepping stones to momentous events! But that is not all. For they spell out across the blue waters of the Mediterranean a pattern of invasion that has progressed far since last summer's first major Commando operation against the French coast.

From Dieppe, you remember, too many of the raiders never got back. But in Tunisia, and on through Sicily, the Allied might plowed inexorably forward, winning objective after objective at a surprisingly low cost in casualties. Air supremacy over the battlefield? Yes. But we have learned, too, how to save lives and shorten the war by strategic air bombardment as a prelude to invasion.

Thus the bombardment plane—rarely seen by the doughboys on the fighting fronts—is destined to save their lives by hundreds of thousands in the decisive attacks that are to come. This fact is confirmed by the cold calculations of the responsible strategists. It will give renewed courage and confidence to every member of the armed forces and of the home fronts throughout the United Nations.

For instance: thorough strategic bombardment of an objective reduces by nearly fifty per cent the surface forces required for invasion. Anticipated losses are reduced from more than fifty per cent of the original ground force to about twenty per cent. Precision bombardment—as used on railroad objectives in Rome—reduces this percentage of loss still further when it is followed by offensive action on the ground.

This is the fifteenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

The inference is clear. Effective prosecution of the war will require smaller ground combat forces and much larger air forces than some of our strategists once thought.

Our most urgent need, then, is for ever-mounting fleets of aircraft. And, fortunately, this is just what we are getting. The American aircraft industry now is producing as many airplanes as all the rest of the world combined. In 1938 we made 100 planes a month. Now we make three times that many in a single working day. By the end of 1943, our production rate will be about 10,000 a month.

But at this stage of the war, types of planes are more important than mere numbers. In the early months the program was heavy, and properly so, with single-engine trainers. Then, as training planes accumulated, the emphasis shifted to heavier types. Now we are turning out multi-engined bombers at a rate that is the envy of the entire world. Some months ago the President revealed that we were manufacturing 500 long-range bombers every month. The figure was conservative even then. And soon we shall be producing planes of this one type at a rate adequate to replace the normal losses of a fleet of at least 1000 American heavy bombers operating as continuously as the weather will permit.

A glimpse of the poundage production may help us still further to evaluate the miraculous achievements of the aviation industry as a whole. It was 89,000,000 in 1941 . . . 291,000,000 in 1942 . . . 911,000,000 in 1943 . . . and 1,417,000,000 in 1944

– if we need it. There you have the magnificent record of the American aircraft manufacturing industry – a monument to the cooperation of industry, labor, government, and to all-out teamwork between the aviation industry and those other industries which have converted their facilities to the manufacture of airplanes.

What of our enemies and our Allies?

German production probably has flattened out at 2500 a month – with downward revision in immediate prospect. Japan may be able to produce as many as 1000 planes a month – until we get our new long-range super-bombers in sufficient numbers to whittle down that figure. Italy may be able to turn out her 500 a month – for a little longer. At best the maximum Axis monthly total is 4000.

Add to our monthly score of nearly 8000, a total of approximately 4000 for Britain, Canada and Russia, and the United Nations score comes to 12,000 monthly. There we have a three to one advantage for our side. And between our own rising production and the brilliant operations of our bomber commands we should soon boost the ratio well above that figure. Therein lies the certainty of continued and growing air superiority over all the far-flung battlefields.

The critics of American airplane quality have been silenced ever since the ratio of enemy combat losses to our own on bombardment missions surpassed four to one. In the Pacific where our heavily armed and armored planes are knocking off the desperately stripped racing craft of the Nipponese, enemy losses often run as high as eight to one or more. In the Mediterranean theater, where the Italians were abandoned by their Allies, the story is much the same. Only in the well-defended homeland of the Nazis do we sometimes drop below the average, but even in those rare instances the ratio is still well in our favor and the effectiveness of our bombardment is adding constantly to our margin.

* * *

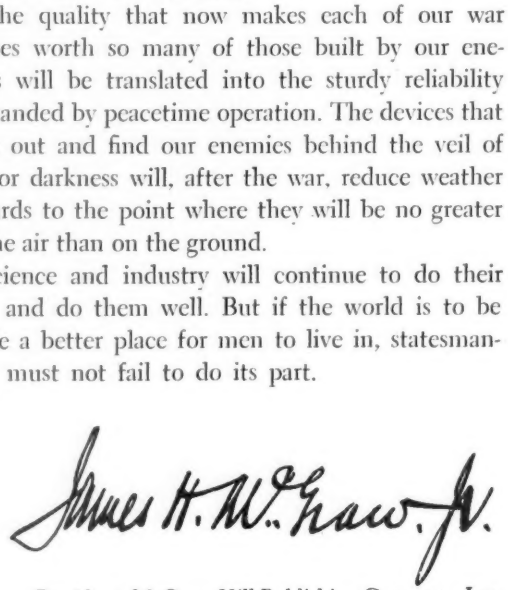
Behind the production lines the battle of research and design still rages. In many a laboratory night-shift, on many a secret test field, new and terrible surprises for the enemy are in the making. Super-bombers, destined for Tokyo, have long since passed out of the design stage and the Japanese may learn about them almost any day. New discoveries, designed to sow swift and silent devastation, are farther along than our enemies believe. No longer will fog or storm or night be permitted to fight on the side of our foes.

The men of science who are toiling to broaden the horizon of our knowledge stand today on the threshold of discoveries that have been sought for centuries. New reservoirs of power may soon exert a profound influence in many fields of technology and through them on our way of life.

Once the war is won these new discoveries will be translated into better living. No longer will countless thousands spend their lives within their own communities or countries. New efficiencies in transportation will bring world travel within the reach of many who once had to stay at home. New family vehicles will navigate the skyways as easily and safely as the highways. Already more than a dozen manufacturers of airplanes, ships, automobiles, and electrical equipment are designing, building, or flying rotary-winged aircraft such as the helicopter or autogyro to meet the needs of tomorrow's families. New and safer aircraft of the fixed-wing type are ready for production as soon as materials become available.

The quality that now makes each of our war planes worth so many of those built by our enemies will be translated into the sturdy reliability demanded by peacetime operation. The devices that seek out and find our enemies behind the veil of fog or darkness will, after the war, reduce weather hazards to the point where they will be no greater in the air than on the ground.

Science and industry will continue to do their jobs and do them well. But if the world is to be made a better place for men to live in, statesmanship must not fail to do its part.



President, McGraw-Hill Publishing Company, Inc.

Electrical Contracting

INTO THE STRETCH

In the declining months of this year the tremendous arsenal that we have created over this land should be hitting its stride. We shall be producing the materials of war at a fantastic rate. And, except for adjustments here and there, the total effort will carry on at a fairly level output.

Right now, however, we are in the period of acceleration toward that level. Some new plants are just turning over their pilot lines. There are a thousand jobs to be finished, and thousands more little alterations to make before we can say our plant, as a whole, is running at full tilt. Nevertheless, the production goals are in sight, and we know now that they can be reached.

And the war news is good too. The slow but inevitable progress of our forces is beginning to show up, first in little successes, then important strategic victories. The losses, too, are considerably less than expected and the effectiveness of newly learned tactics greater than could ever have been anticipated. So, on the fighting fronts, the goals are in sight and we are now certain that they, too, can be reached.

If we were in the bleachers with the seventh inning coming up, we could get up and go home now. A lot of folks, we are told, are doing just that. Only there's no bleachers in total war. There are no fans. There are only players. And no matter how inevitable the final score looks now, our fond predictions are based on aggressive persistent play right through to the end.

The real success of the production effort so far is that of a strong start. The big job is still ahead. During the last few months there has been an alarming let down, not in production totals, but in the rate of climb, enough, however, in certain industries to affect military planning. A powerful effort will be made in the closing months of the year to bring it back, but it won't be easy.

And right here the electrical industry has a grave and urgent responsibility—a responsibility to upgrade and adapt its services to the needs of the moment. New construction is slowing down. There are management and labor resources in this industry that are not being used to capacity. On the other hand there are ships to wire, industries to light and electrical production jobs that need every possible experienced skill that we can throw into the job.

These new responsibilities won't walk in the door. It is pretty much up to us as individuals and as an industry to convince those in charge that they are our jobs and that we are prepared to handle them. It will call for a new kind of salesmanship backed up by a high order of performance.

Wm. F. Stuart

SEPTEMBER, 1943

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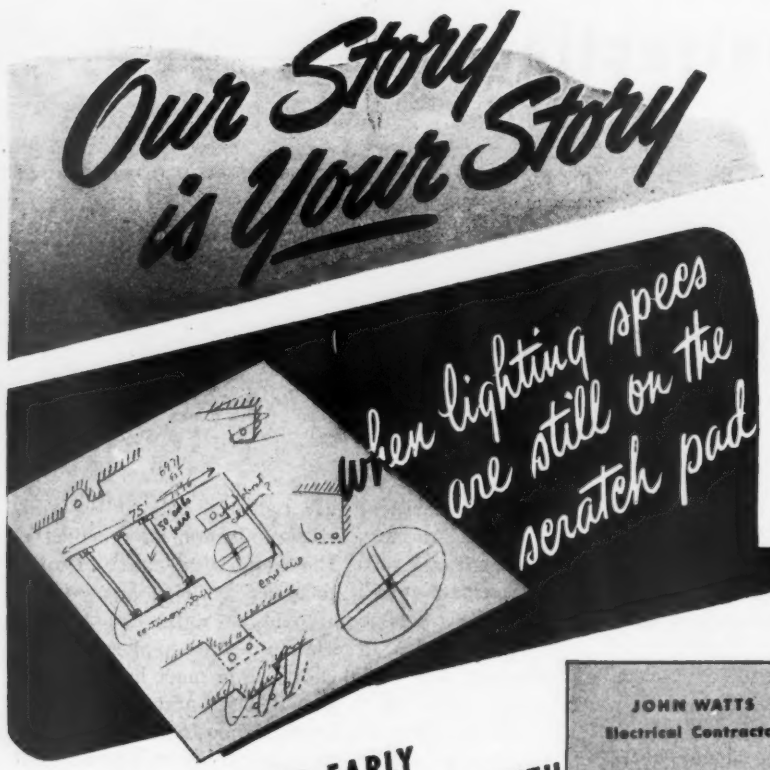
ELECTRICAL CONTRACTORS:



Here is one of a series of messages "via Graybar" telling the story of the electrical contractor to some 40,000 architects, builders, and other leaders in the building field. It appears in the current issue of "Architectural Forum". It is one phase of Graybar's effort to emphasize the essential place of electrical contractors in war and in peace, and to encourage more effective use of their experience and facilities.

For our part, Graybar Men are ready to back you up to the limit with the information and supplies needed for efficient, prompt performance on the job.

GRAYBAR ELECTRIC COMPANY

JOHN WATTS
Electrical Contractor

...IT'S NOT TOO EARLY TO START WORKING WITH

Today, almost any lighting job you plan involves a multitude of new problems—and new possibilities—as to equipment, wiring methods, installation detail. So does everything else on the electrical side of the building industry from doorbells to power distribution.

To make practical economical use of new items—and to make sure that *everything* you specify, new or old, meets local conditions and regulations—there's one sure source of help. Put it up to "John Watts", a qualified electrical contractor familiar with conditions in the area.

Put it up to him early, if possible, before plans have "jelled" and the specifications are drawn up. Let him judge the practicality of innovations, check with him on the availability of supplies, let him advise on the surest means for steering clear of "extras".

A competent electrical contractor, working with you from the start, can often increase the effectiveness of your plans and smooth the way to faster completion of the job at lower cost. Choose him carefully, of course—but equally important—call on him early!

Give Your Electrical Work to "John Watts"—a qualified electrical contractor—heading a well-established firm with the trained organization, tools and know-how to give you specialized assistance on wiring, lighting, signaling, power supply, electronics. From offices and warehouses in over 80 cities, GRAYBAR serves a nation of "John Watts", helping them to help you by supplying the newest and best in electrical materials.

Graybar

Executive Offices: Graybar Building, New York 17, N.Y.

INDUSTRIAL ELECTRONICS

New opportunities and new responsibilities are created by the swift advance of the electronic art into industry. The first of a series on the fundamentals of industrial electronics and their application.

By W. T. Stuart

ELECTRONICS is a great new industry, growing by leaps and bounds under the enormous pressure of war. It will have a profound effect on electric wiring and apparatus in the years to come. In industrial processes, in commercial facilities and home gadgets we are going to see more and more tubes replacing conventional electrical devices and doing things we haven't thought of yet. Our industry will have to absorb these new developments and the new techniques they bring by continued study, observation and ready adaptability. Electronics introduces new complexities, new problems, new responsibilities. But it also throws open the gates to a vast new world of opportunity.

We have all been letting electrons run around in some of our best wiring systems these many years. No one, outside of the cloistered research laboratories, cared much. Electrons were doing their job of conveying energy for light and power and a great industry grew without knowing much about them. A heated cathode and an anode in a vacuum, however, brought the electrons out into the open where their characteristics could be observed and the flow controlled. And from this phenomenon grew radio and what we now call the electronics industry. Electronics has been defined, in fact, as the field of electrical phenomena involving a flow of electrons through space.

Electronics is today a word of great import. Its accomplishments and predictions are firing the imagination of the whole world. And, more to the point for electrical men, it is now a 4 billion dollar industry, greater than the automobile business at its peak. While the great bulk of that volume is in communications and secret military devices, electronic apparatus has already found a substantial place in industry and promises to go much farther in the post war era.

Electrical contractors and industrial electrical men concerned with the application, installation and maintenance of electrical apparatus in industry are vitally concerned with these developments. They have to install and hook up the devices, keep them in operation and, equally important, they must be sufficiently well informed to be able to exercise sound judgment in recommending and applying electronic apparatus. And much of the future progress of electronics in industry will depend upon the judgment and understanding of these men.

There are important responsibilities resting squarely upon every one of us in bringing the benefit of electronic progress to the folks we serve. The manufacturer, naturally concerned with his major markets in broadcasting, radio and communication, has been inclined to treat industrial electronic apparatus as a specialty. He has a responsibility to educate and inform the men who must eventually sell, install and service his market. He must place the ignitron, for instance, along side of the m-g set in the conventional thinking of our industry. The industrial contractor, on the other hand, has the responsibility of keeping close contact with electronic developments and arranging his engineering sales and service functions to bring its benefits to his customer.

Getting down to the grass roots of electronics, we find little that is basically new. The important developments in the application of electronic devices to industry are, by and large, practical adaptations of apparatus that grew up in radio. And one of the reasons that

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***ELECTRONIC REGULATOR** on small switchboard panel holds this paper mill drive accurately constant at any speed. Operation is automatic and extremely sensitive.*

***RESISTANCE WELDING** of thin metal requires accurate timing. Here a Westinghouse precision electronic sequence timer regulates the welding current.*

industrial electronics has advanced with such amazing speed in the past few years is the high order of perfection already attained in the manufacture of the various elements. Vacuum tubes are strong, stable and as predictable in characteristics as a motor or a controller. The resistors and condensers used in electronic circuits are standardized and available in any degree of precision. Instruments for testing and analysis are probably far more advanced than in any other field. Further, the problems of industrial electronics, as a rule, involve less complex circuits than those of communication and broadcasting.

There are jobs that electronic equipment can do for industry better than any previously available apparatus. Some are impossible by any other method; for instance:

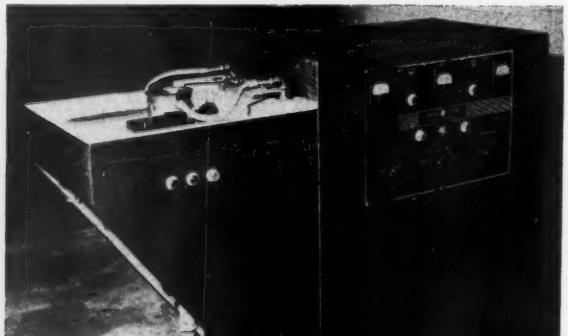
1. Split second control of heavy welding currents.
2. Industrial X-ray inspection techniques.
3. High frequency heating processes.
4. Photoelectric control problems dependent upon light or flame.

Another group of jobs involve electronic apparatus which replaces previous methods; for example:

1. Power conversion of a.c. to d.c. for industrial uses.
2. Industrial control in which electron tubes provide the automatic features, relaying or circuit interruption.
3. Limit switching, safety and other control devices using phototubes and light beam interruption.

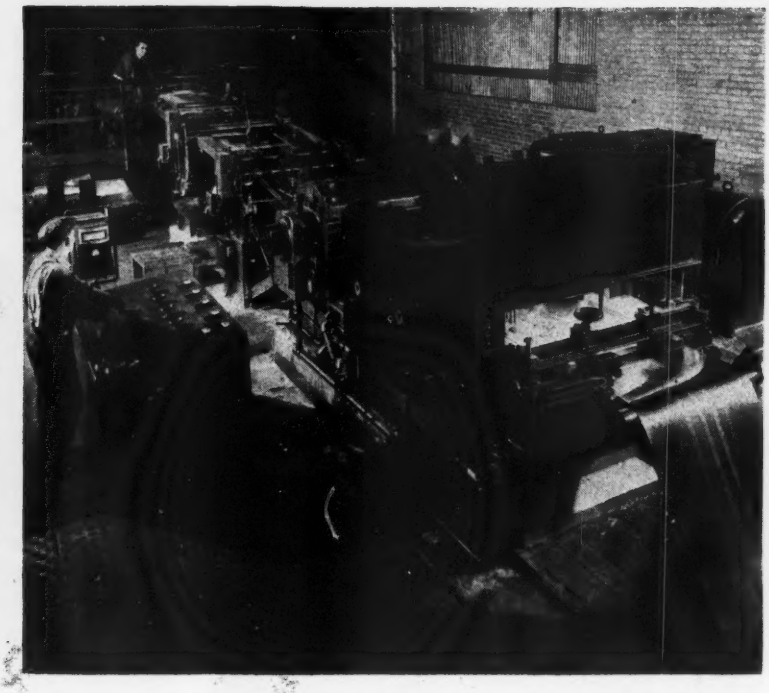
A full enumeration of industrial electronic uses is beyond the scope of an

***TUBE COMPLEMENT** of an electronic motor controller providing hair line accuracy of speed control over a wide range. The larger tubes handle the power, smaller tubes handle the precise control features.*



***HIGH FREQUENCY** electric heating of metal parts has revolutionized heat treatment and hardening. This machine is a General Electric five kilowatt electronic oscillator for induction heating.*

***PHOTOTUBES** "watch" the testing during production of watthour meters, one of the many types of industrial jobs effectively handled by this versatile electronic tube.*



***DETECTING PINHOLES** in tin plate racing through a shear at 1000 feet per minute. The electronic device spots, classifies and marks the minute holes.*

article of this length. There are hundreds of applications, precision measurement, safety controls, process control in chemical manufacturing, air cleaning, welding, heat treatment, sorting, grading and so on. The eventual field of application is, as far as we know, unlimited.

The most prevalent application of electronic apparatus in industry today, however, is in specialized equipment where accurate split-second control is important. Spot and seam welders are timed to allow heavy welding currents for accurate intervals as short as a fraction of one cycle. Thin layers of tin are flowed on steel plate by induction under accurate temperature control. Cloth is aligned on rapidly moving rollers in textile plants. X-rays inspect the structure of heavy armor plate. And precise operation of motors to critically close speeds under varying loads is provided by one of the most recent and versatile developments.

The heart of an electric clock is its tiny synchronous motor. Add the conventional works; gears, face, hands, frame and case; and we have a useful and accurate timekeeper. The heart of electronic apparatus is the tube to which must be added various conventional circuit elements to make it perform. There are about 750 different tubes made for hundreds of variations in capacity and characteristics but practically all fall into one of these general types and uses.

1. High vacuum rectifiers are used generally for rectifying high voltages with comparatively low current requirements. A typical use is in electrical precipitation apparatus in which high d.c. voltages ionizes the air and charges dust particles which in turn adhere to oppositely charged plates.

2. Gas-filled rectifiers are used as general purpose uncontrolled rectifiers for currents up to about 30 amperes. They supply d.c. for such operations as magnetic chucks, battery charging, magnetic separators or wherever an isolated block of d.c. power is needed.

WHAT TO READ

For good practical data on industrial electronics and enough basic theory to make it understandable the following books are recommended for men already familiar with electrical fundamentals.

Electron Tubes in Industry
by Keith Henney
McGraw-Hill Book Company *$5.00*

Industrial Electronics
by F. H. Gulliksen and E. H. Vedder
John Wiley & Sons, Inc. *$3.50*

Engineering Electronics
by Donald G. Fink
McGraw-Hill Book Company *$3.50*

3. Ignitrons, gas-filled tubes with a mercury pool cathode and an ignition electrode, are used for heavy duty rectification. They supply the heavy currents used for welding and are used in place of rotating machinery as a source of industrial d.c. power. Banks of ignitrons, for instance, supply the enormous d.c. currents used in making magnesium and aluminum in some of the new war plants. The ignition electrode provides very accurate control.

4. The thyratron, a grid controlled gas-filled tube, is probably the most versatile of industrial electronic valves. As in the ignitron, the control element acts as a trigger controlling the start of the flow of current through the tube. Thus the thyratron can be operated with split second precision from other electronic tubes such as phototubes to control, with an ignitron, heavy welding loads.

5. Amplifier and oscillator tubes, the pliotrons, are high vacuum tubes with one or more control grids. They are used to provide high frequency power for induction heating such as surface hardening and tin brightening. In the smaller sizes these are the familiar radio tubes and are used in many of the control circuits of industrial electronic apparatus.

6. Phototubes contain a cathode which emits electrons in the presence of light.

(Continued on page 133)

UMI

TRANSFORMER

The absence of replacements and heavier loading makes transformer maintenance

***TEMPERATURE READINGS** for oil transformers should be taken with alcohol thermometers as mercury is an excellent conductor and might cause damage if broken. Temperature should not exceed 80° C. Wrenches, screwdrivers and thermometers should be tied securely to the inspector's belt for retrieving if dropped.*

***THE FIRST THING** to check to determine the condition of a transformer is the oil. Oil of normal dryness will test 22 kilovolts or higher in the standard test cup. Here oil samples drawn from the bottom of the tank are being tested in a portable oil testing outfit. This test should be made at least once a year.*

By W. W. McCullough
Westinghouse Electric and Mfg. Co.

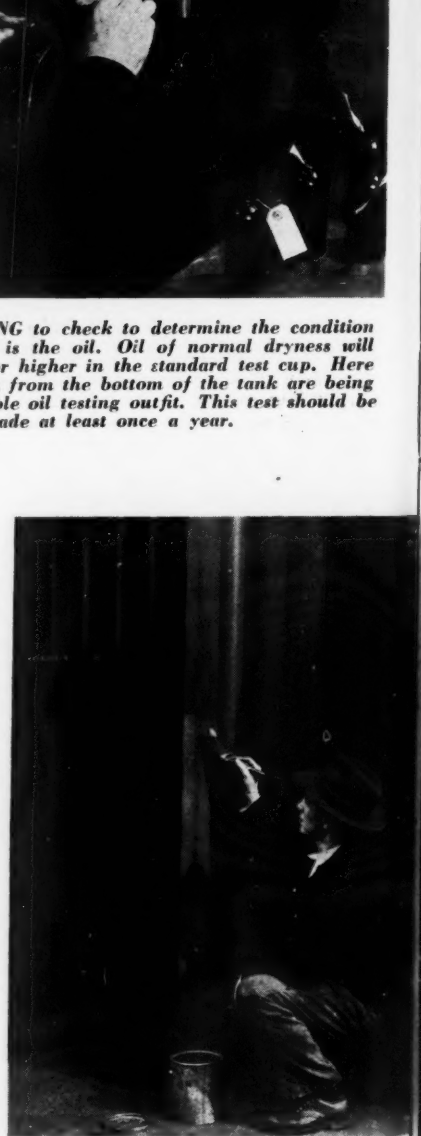
ALTHOUGH transformers require less care and attention than electrical machinery with rotating parts, they cannot be neglected. A regular program of inspection should be established and rigidly maintained. The frequency of such a program will depend to some extent on the condition under which they operate.

Proper maintenance falls roughly into two general classifications. First, regardless of size, the integrity of the insulation separating the electrical circuits from each other and from the magnetic circuit must be maintained. Second, the cooling system must be kept efficient to assure the free flow of heat. Insulation must be of good quality, of sufficient amount, and properly distributed. Mechanics of heat dissipation must keep the operating temperature of the transformer within safe limits.

Cleanliness is just as essential to good service in a transformer as it is in a motor. This means that the outside of the tank must be kept clean and that all gaskets be maintained so as to exclude dust, dirt, and moisture.

The assembly of core, coils and terminal board inside the tank must also be kept clean. Sludge and sediment from the oil which finally encrusts the assembly must be removed. It is important also to keep sludge from accumulating on the inside surfaces of the tank for sludge clogs coil ducts and interferes with the circulation and cooling effect of the oil.

Normally, under load, the copper coils are the hottest part in a transformer. It is out of the question in most cases for a maintenance man to determine the actual temperature. The best guide is the temperature of the oil. On an aver-



***ALL HEAT - RADIATING** surfaces should be clean and free from oil and rust. Paint tanks and covers as often as required by local conditions.*

MAINTENANCE

more important than ever before.

age, the drop from copper to oil is 10 deg. C. and from oil to air 30 deg. C. Temperatures as indicated by tank thermometer should not exceed 80 deg. C.

Certain safety precautions should be taken when working about a transformer. Particular care must be taken in handling all tools and other loose articles, since material dropped into the windings and allowed to remain may cause a breakdown. Wrenches and screw drivers should be tied to the inspector's belt so that they may be easily retrieved. When it is necessary to take temperature readings inside the tank choose alcohol thermometers. Mercury is an excellent conductor and might cause trouble should the thermometer be broken. Never assume that a transformer is de-energized. Make sure breaker or switch is open. Ground all primary bus with standard grounding cable. After work is completed make sure all is clear before energizing. Your own life and the lives of others may depend on this. The tank of every power transformer should be grounded to eliminate the possibility of shock.

Polarity is of interest to maintenance men primarily on account of its importance to paralleling or banking two or more transformers. In order to simplify the work of connecting transformers in parallel, all leads brought out of the case or tank are marked by a system of letters and numbers. The lead marking appears on the diagram nameplate or connection diagram which accompanies the transformer. The polarity of a transformer is determined by the lead markings. When X-1 is located diagonally with respect to H-1, the polarity is, by definition, additive. When H-1 and X-1 are adjacent, the polarity is said to be subtractive. However, take the precaution of checking with a voltmeter before making final connections.

MAINTENANCE CHECK CHART FOR OIL-FILLED TRANSFORMERS

KEEP OIL IN GOOD CONDITION

Test dielectric strength at least once a year. If less than a minimum 18 kv. in standard tester, recondition oil or replace.

MAINTAIN OIL AT PROPER LEVEL

Check oil level every three months. Add new make-up oil where necessary and stop leakage.

WATCH OPERATING TEMPERATURES AND LOAD

Test operating temperature of fully loaded transformer once a month. Check load with ammeter if too high. Temperature should never exceed 80° C. by tank thermometer.

INSPECT GROUND CONNECTIONS

Check weekly. Keep tight and in good condition. These are important to safety of employees. Never run ground wire through iron pipe.

INSPECT EXTERNAL CONNECTIONS

Check weekly for loose connections which may cause heating. Vibration may cause bolts to loosen.

WATCH HEAT-RADIATING SURFACES

Keep tanks, covers and all other heat-radiating surfaces clean and free from both rust and oil. Protect these surfaces with paint.

KEEP BUSHINGS CLEAN

Wipe porcelain bushings at shut down periods.

AIR-COOLED TRANSFORMERS should receive periodic cleanings to remove any dust or dirt that might have accumulated in the air ducts. Frequency depends on location. Air should be free from moisture and not over 50 pounds pressure. When only greater pressure is available, care should be taken so that hose nozzle is not applied too close to the windings.

In an emergency use lamps or a piece of fuse wire.

Oil-filled transformers carry the main load of industry. The oil provides an insulating medium which also carries heat away from the windings and core. This insulating oil is just as much a part of the apparatus in which it is used as any of the other materials making up the transformer assembly.

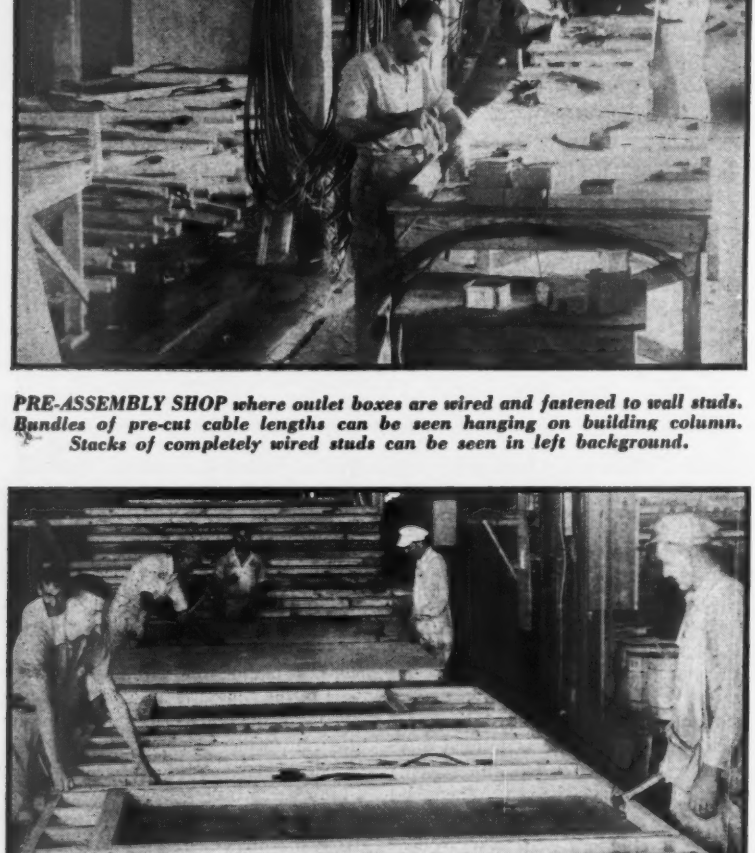
The principal causes of deterioration of insulating oil in service are water and oxidation. The oil may absorb moisture from the air taken in by breathing of the transformer, especially when the transformer is not continuously in service. Oxidation causes sludging, the amount of sludge forming in a given oil being dependent upon the temperature and the time of exposure to the air. It must be realized that a minute quantity of water will spoil the insulating qualities of transformer oil. A

[Continued on page 138]

PREFABRICATED

Walls are completely wired before sections are taken to erection site. Specialized crews do an assembly line job to expedite housing project.

***PRE-ASSEMBLY SHOP** where outlet boxes are wired and fastened to wall studs. Bundles of pre-cut cable lengths can be seen hanging on building column. Stacks of completely wired studs can be seen in left background.*



***WALL SECTIONS** are completely assembled on these benches. Completely wired stud can be seen alongside door opening. The section is now ready for second wall covering.*

A GREAT saving in time, labor and material has been effected by shop preparation of wall and ceiling sections that constitute the prefabricated house. Many interesting developments were made in coordinating electric wiring with prefabricating methods of construction before we finally settled on our present procedure. Barrett and Hilp were the general contractors and we held the electrical sub-contract for the housing project in Norfolk, Va.

Procedure

All wire and switch boxes were delivered to the plant where they were cut to the proper specifications. The cutting was done by two men. A coil of wire was fed out by one man to his helper who carried the end along the edge of a work table which had graduated markings. When the desired length was reached, the man feeding out the coil cut it off with an ordinary hand hatchet on a small block nailed at the feed end of the table.

These cuts were tied in bundles of ten and carried to the stripping machine. The stripping machine split the insulation on the non-metallic cable for the required length of leads and the exposed jute and wrappings were cut away. The separate bundles were then delivered to the make up tables where switch boxes were nailed to the pre-cut wall studs and the cable installed as per the proper wall section plans. The pre-wired studs were then distributed to the wall jig tables in accordance with the types of walls that were being constructed.

Cables Looped

After the pre-wired stud had been installed in the wall on the jig table, but before the second covering had been nailed on, the electrician looped the cable between the pre-wired stud and the next adjoining stud, notched the upper plate and stapled the end of cable to the top side of the upper wall plate.

House Wiring

By L. Stolowitz,
General Manager,
Associated Electrical Construction Corp.,
San Francisco, Calif.

After both sides of the pre-wired walls were covered they were ready for delivery to the erection site.

After the walls were erected and the ceiling sections were installed, the electrician then removed the staples from the upper wall plates, pulled out to their full length the respective cables, and carried them to their proper ceiling outlets. The ceiling outlet boxes were installed at the site in holes that had been pre-cut in the ceiling covering by template at the plant. The field roughing had now been completed and no further work was performed until interior wall painting and cabinet work was complete.

After this, the fixture crews tested the wiring, made up joints for proper continuity of circuits and installed the lighting fixtures, convenience plugs, switches, plates and ground clamps.

Inspection

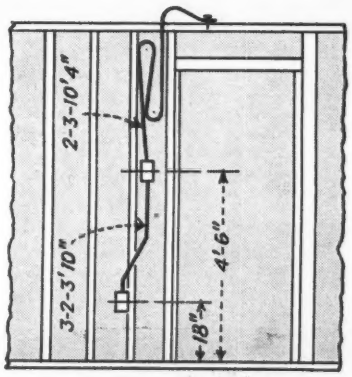
The inspection crews followed. Their duties were to thoroughly test each house by available means (when no 110 volt electricity was at the site) such as bell and battery, for ground, shorts, and continuity of circuits. They also examined for workmanship and omissions, installed fixture glassware, and made all repairs and corrections as they occurred. This concluded the installation of the electrical wiring ready for connection to outdoor electrical utilities.

It must be remembered that this project was started at a time when the war industries and shipyards were absorbing all of the available skilled and semi-skilled electrical workers. As housing was considered of secondary importance, it became almost impossible to locate skilled electricians. John Russell, the local IBEW business agent, immediately recruited unskilled workers from farm, village and town and assisted us in training them for our particular type of work. These men represented nearly every state in the southeast, and they did a magnificent job. The one thing which made the job possible was the use of assembly line methods whereby the worker was trained to do one specific job.

Some of the outstanding quantities of basic wire and materials that were used on this project were: 410 miles of wire, 95,000 outlet boxes, 5,000 switch panels, 500,000 cable staples, 30,000 toggle switches, 30,000 convenience outlets, 50,000 wall plates and 35,000 lighting fixtures. By the use of combination light and plug circuits a 20 percent saving was effected in the lineal feet length of cable required to wire a house, all underfloor work being eliminated.

The following bill of material was required for rough wiring a single four-room unit:

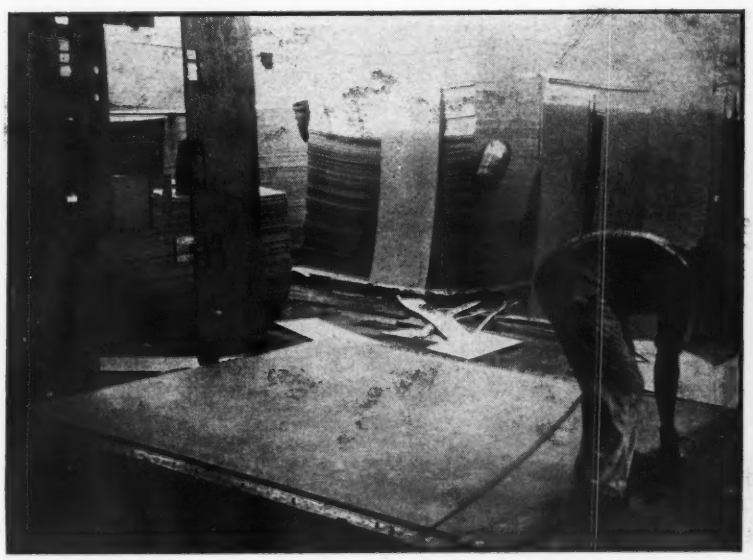
121 feet 14-2 non-metallic sheath cable
56 feet 14-3 non-metallic sheath cable
1 two circuit switch panel
4 feet 8-2 type "U" entrance cable
8 feet 6-in. ground wire
1 ground clamp
4 cable box connectors
75 cable staples



***CABLE LEADING** from base outlet to ceiling outlet is looped between studs and wall covering, and is stapled to upper plate. After erection, staple is removed, cable is pulled out to full length, and run to ceiling outlet.*

6 outlet boxes and hangers
12 bracket type switch boxes
40 8d common nails

In addition the following fixtures and finish material were required: one outdoor lantern, two bedroom fixtures, one living room fixture, one kitchen fixture, one bathroom fixture, one hall pull chain socket, six single pole switches, four single gang switch plates, one two-gang switch plate, six duplex plug receptacles. Eleven normal wire nuts, and seven medium wire nuts. Each dwelling unit contains seven light outlets, six switches and seven convenience outlets.



***TEMPLATES ARE HINGED** to table for marking and cutting wall and ceiling coverings. Receptacle, switch and bracket openings are cut and the covers nailed to the studs.*

UMI

Light Conditioning For ARC WELDING

A carefully engineered lighting installation increases visual comfort and productive efficiency of army tank welders at the Marmon-Herrington Company in Indianapolis

***SHARP CONTRAST** of welder's arc in dark surroundings produces a "cloud-effect" which high intensity general lighting tends to eliminate.*

WITH the increased use of arc welding on America's production lines, the need for adequate and proper type of lighting is becoming acute. Inflamed and burning eyes is a serious occupational disease among welders which reacts on the physical well being of the person as well as his productive capacity. The sharp contrasts between welding arcs and the surrounding area where large scale welding, such as on tanks is done, is also a hazard to non-welding employees working in those areas.

In the past, welding areas and booths have been traditionally dark in color. Perhaps this was due to housekeeping problems and the assumption that dark interiors or walls do not reflect the rays of the welding arc. The phenomenon of contrast was apparently overlooked or regarded lightly.

B. J. Smith, director of planning for the Marmon-Herrington Company, Indianapolis, was cognizant of these facts when he undertook the job of expanding the department where army tanks are welded. He knew the high degree of skill, co-ordination of hand and eye and the high visual sensitivity that arc welding demands of the employee. Combining a determination to overlook nothing that would contribute to the welder's comfort and efficiency, and a knowledge of lighting and the effects of contrast, he sought a method of combating welding arc brilliance with light, paint or both.

The welder's view of the arc is tempered by filter glass in his hood, dense enough to screen out most of the ultraviolet and cut the brightness to an eye-strain level of about one percent. This meant that the spectral quality of the illuminant should complement the transmission range of the shielding filter. Paint also had to be investigated since its reflection factors must complement the high-level lighting, reduce contrasts and absorb as much as possible of the ultraviolet radiation from the arc.

Careful observation of welding arcs indoors and outdoors in the sunlight and a thorough study of relative intensities led to the design of the following lighting installation as the answer to the problem:

Type of Lighting Unit—Illumination was provided with RLM dome units equipped with a 400-watt, Type H-1 Mercury lamp. Most of the light produced by these lamps is radiated in the yellow-green and green portions of the

[Continued on Page 140]

***HIGH INTENSITY LIGHTING** applied in open-area welding increases employee comfort and efficiency, reduces harsh arc contrast and the resultant "flash-jitters" that non-welding employees may experience.*

F. A. DONAHUE, Bohack sales manager, (center) talking to two Westinghouse engineers. The box on each Sterilamp fixture contains the starting and operating transformer. By the way, would you be interested in a side of beef?

ERNEST HABERLE, president H. C. Bohack, Co., Inc. congratulating his chief engineer H. F. Hoerschelman on completing the installation ahead of schedule. Morris Eisenberg, electrical contractor at right also received congratulations. The three booster transformers can be seen mounted atop the control panel. Sterilamp circuit switches are located in cabinet in lower section of panel.

Sterilamp Installation

Voltage control from 100 to 130 volts and conduit sealing are features of this germicidal lamp installation for curing beef.

THE Tenderay process equipment installed for the H. C. Bohack Co., Inc., of Brooklyn, N. Y., for tenderizing meats is an example of one of the specialized types of wiring jobs that will become important factors in the postwar market for electrical contractors. This installation was made by electrical contractor Morris Eisenberg under the direction of H. F. Hoerschelman, chief engineer for Bohack.

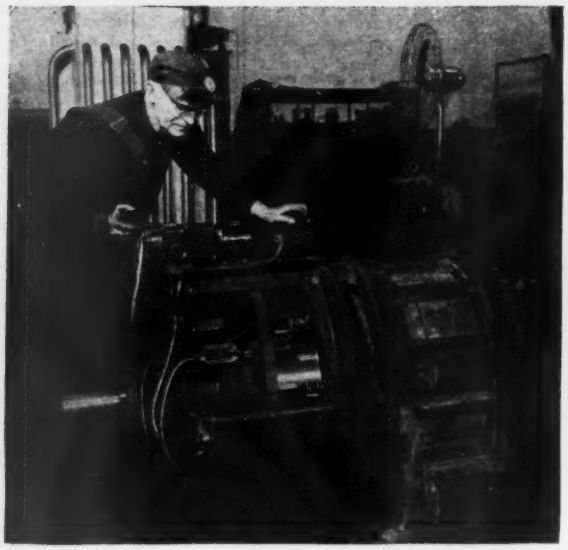
The process requires that close temperature and humidity control be maintained in both the process and chill rooms. In the process room the temperature is held at 63 deg. F. and humidity at 85 to 90 percent. Here the beef remains for from 48 to 72 hours to allow the muscle connective tissue to relax. The greater the relaxation the more tender the steak. Originally the beef was "aged" for from six to eight weeks at 35 deg. F. and 70 to 80 percent humidity to obtain the same degree of tenderness.

At the 63 deg. F. temperature the meat might spoil were it not for Sterilamps which emit ultra-violet rays in the 2537 angstrom unit range. These u.v. rays kill the bacteria which produces the slime and mold found on beef aged six weeks or so. The 30-inch Sterilamp tube is made of a special high frequency transmission glass and contains neon, argon and low pressure mercury vapor. The fixture contains a transformer rated 115/1000 volts on open circuit and 115/500 volts when operating. The 1000 volts enables the lamp to start and once started operates at 500 volts. Each lamp consumes 20 watts and approximately one inch of lamp is installed for each square foot of floor area.

The entire system of humidity, temperature and lamp operation is controlled from one panel. The process and chill room each has separate relay control which also indicates the temperature and humidity. Compressed air operates all valves. Air and steam pressure indicators are also on the panel. Seven circuit breakers control the 3-phase power circuits; one to the air compressor and two each to the fans, brine and circulating pumps. The Sterilamp branch circuit switches are located in the cabinet at the bottom of the panel.

Booster transformers were installed on the lamp circuits with six steps (of 3 volts each) boosting and six steps bucking. This gives a circuit voltage variation from 100 volts to 130 volts. When the lamps are first installed the circuits carry 100 volts. Then as their ultra-violet output drops off the voltage is boosted until finally the lamps reach the end of their useful life at 130 volts.

[Continued on Page 141]



VARIABLE-SPEED a.c. motor is about to be dismantled in the repair shop where it is completely overhauled and put in first class condition.

WORN BEARINGS are located by checking the air gap. Here the gaps on a 150 hp. ammonia compressor motor are being checked.

Preventive Maintenance

Years of experience have proven the superiority of preventive maintenance with its routine inspections catching trouble before it happens.

NEW industry faces the problem of how best to organize their maintenance department; older industries, how to improve its functioning. Pressure brought to bear by the present emergency has ushered the maintenance organization into the foreground as an important factor to successful production. The two go hand in hand and are inseparable. Increased production can be obtained only at the expense of better maintenance. The overloading of equipment, scarcity of replacement parts and long shipments entailed demand that more attention be given to the improvement of operation of the maintenance organization.

P. S. Karr, chief electrician of Armstrong Cork Company, Lancaster, Pa., has functioning under him a maintenance department which presents an excellent pattern of good organization. The principles by which it functions are so basic and fundamental that they can be adapted to any system of maintenance, regardless of its size. The frame work of his organization is not the result of any immediate conclusions. It has been the result of years of experience. It has kept pace since its inception with the growth of the industry which it sustains.

One assistant aids Karr in keeping the gangs operating at top efficiency. Six gangs, each with a gang foreman, have specific duties for which the men have been individually trained; a routine inspection gang, an emergency or trouble-shooting gang, one responsible for the complete operation (mechanical and electrical) of cranes, elevators and hoists, one for meters, clocks, relays, etc., one for new and reconstruction and lastly the repair shop crew.

The construction gang is continually making new installations, running feeders, rearranging circuits, installing raceways, conduit systems, control, replacing motors, etc.

The meter gang maintains all clocks, relays, meters and instruments by periodical testing. In this way, the operators of various production processes, which are meter and relay controlled, are assured of continued satisfactory operation.

The crane, elevator, and hoist gang have charge of the complete maintenance of that type of equipment. Some time back there was a division of responsibility and lapse of duty on inspection between the mechanical and electrical gangs, so Karr took over complete responsiblity to prevent further misunderstanding and resulting inefficiency. His boys now maintain in addition to the control, motors, trolley wires and feeders; all gears, pinions, shafts, bearings, wheels, tracks, bridges, carriages, cables and gondolas. In other words they care for everything connected with and pertaining to cranes, elevators and hoists.

The trouble-shooters carry the mail. When the unexpected happens they move and move fast. Their sole responsibility is to locate trouble and get equipment back into operation. Certain designated men in the construction gangs are at their disposal if extra manpower is required for emergency replacement of motors, control, feeders, and the like.

The repair shop gang receives all defective equipment brought in by the trouble-shooter and construction crews. All equipment is restored to first class

INSULATION TEST—When the value drops, the unit is replaced by another while it is sent to the repair shop for necessary reinsulating and baking.

INSTRUMENT CALIBRATION, repair and maintenance is conducted in the meter shop. Here a recording meter is given its periodic calibration by use of a standard.

Organization

condition, thoroughly tested and held ready to be placed back in service. Coils, transformers, and motors are rewound or reinsulated, dipped and baked. Controllers are repaired. Commutators are trued up and undercut. Shafts, gears, pinions, keyways and various other mechanical parts are machined. Their repair work extends from renewing contacts on the tiniest relay to rewinding the huge motors on the large linoleum presses.

Last and most important of all is the routine inspection gang. Schedules for regular periodical check-ups have been made up out of agreements between Karr and the various foremen throughout the plant. The schedules are flexible in that they are continually being revised, depending entirely upon the operation of the plant equipment. During a period when a machine is operating 24 hours a day, seven days a week, the number of inspections are more frequent than if the machine is operating only one shift, five days per week. Close cooperation with the foremen is necessary for a successful preventive maintenance campaign such as this. Their combined efforts are a means to the same end—increased production. Production cannot be increased with continually breaking down machinery. The foremen have come to a realization of this the hard way. When the "supers" began asking for more production the foremen discouraged short shut-downs for routine inspections branding it as "wasted time" in this emergency. Increased loading of machinery and the absence of inspections soon led to breakdowns in an ever increasing number until finally the management stepped in to find out why production was actually falling off instead of increasing. Karr had the answer on the tip of his tongue. As a consequence scheduled inspections were resumed.

Agreements are made in this way. The foreman says, "You can have machine No. 29 on Tuesday at 2:30 p.m. for 20 minutes," and Karr has his boys there ready to go to work at the appointed hour. Or the foreman calls Karr up to say—"Machines No. 36, 39, 42 and 46 are going on 24 hours, seven days a week next Monday and they will be available for inspection at such and such a time for so long—will that be suitable or do you think we should inspect them more often now?"—and the two come to some sort of an agreement.

No cut and dried rules can be laid down as to how often equipment needs inspecting. It is entirely a matter of good judgment based on experience gathered from the history of the equipment. Karr keeps a complete record of every piece of electrical equipment in the plant. Various forms are available for the men to fill out whenever a piece of apparatus is inspected, worked on, or replaced. These forms are also a product of years of "cut and try" experience.

The stockroom has become a separate operating unit. When new equipment is installed Karr sends a memo to "stock" as to which and how many replacement parts shall be kept on hand. Here again no rules can be made as to the extent of stock parts. Judgment from past experience and a knowledge of the equipments intended utilization are required. Requisitions signed by gang foreman are used to draw stock. Stocks are automatically reordered to conform with the minimums and maximums specified by Karr at the time of installation. When equipment is retired from service its stock is labeled inactive. When any particular item is drawn upon too heavily or too lightly, Karr is notified and an investigation is made to determine the cause. In this way, his judgment is governed when specifying future maximum and minimum stocks.

It is to be remembered that the present organization is a result of years of experience, hard work, keen judgment and study of factors involved. Much of its success is attributable to the many valuable suggestions which have come in through the years from the gang foremen and their men.

UMI

EDITORIALS

W. T. Stuart, *Editor*

Light for Inspection

With the Truman committee swinging a threatening club and the FBI snarling epithets, war industry management is what might be called inspection conscious. Inspection, as a natural result of recent investigations and indictments with widely publicized threats of more to come, has become a bottleneck. Everyone even remotely concerned with inspection responsibilities is moving with extreme caution. It is pretty certain that no sub-specification material is getting by today. Unfortunately we are enjoying this certainty at the expense of seriously reduced output and the waste of a lot of material that falls short, by some insignificant characteristic, of the specified standards.

There isn't much that can be done to keep investigators and prosecutors from gumming the works. That is inherent in their methods. And those who want to avoid becoming their victims will lean far backward, obey the letter of the specifications and meticulously follow the rules.

There is, however, a lot that we can do to help management restore production levels. And that is to push high quality lighting with new vigor and persistence.

In the field of inspection lighting especially there is a wide open opportunity for the exercise of the ingenuity, skill and experience that has always characterized our industry. Inspection lighting problems have as many variations as there are jobs. They defy standard formulas and the only way to lick them is to place an experienced lighting man on the job with enough experimental sources and reflectors to find a practical solution. This kind of cut and try work is expensive and exacting, but anything that will ease and speed the inspection technique will be more than welcome at any price.

As for cutting rejects by improving quality down the line, the relationship of well engineered lighting to quality output is too well known to need special emphasis here. But it is a story that must be told over and over again, to management, to management-labor committees and to war agencies.

Metals for Electrification

The electrical industry, as a whole, has been cooperating splendidly with WPB to curtail the use of critical metals so that larger amounts may be available for "direct" war uses or other essential civilian purposes. So cooperative, in fact, that it is a question now whether we have not gone too far, especially in the elimination of metals from protective features of our wiring systems and apparatus, and in capacity loading of wiring and equipment.

To discard peacetime standards under the pressure of wartime scarcity is, of course, a vital responsibility. On the other hand it is also a vital responsibility for those who are familiar by training and experience, with such a technical service as electrification, to resist limitations before they bring hazards to the total war effort of more serious import than can be justified by the savings in material.

Consequently, it would seem to us that limitations ought to be periodically reviewed and revised in line with improvements in the supply of metals. And there is every evidence that the metal situation is improving.

Aluminum capacity, for instance, is seven times what it was only a short time ago. There is a persistent rumor that some of the newer plants will never have to be pushed to capacity output. Magnesium is "sticking out of our ears" as one government executive put it. And while copper still rates as extremely critical, nothing is said of the enormous resources of battle scrap that inevitably falls to an advancing army. Then we have within our borders over half of the steel making capacity of the world, and more building. Even considering the enormous material needs of planes, guns and ships, this is a better picture than obtained in the days when most limitation orders were conceived.

To take a specific case, L-225, the conduit limitation order, in those paragraphs denoting just where and how conduits and raceways may be used, is an important concession. It presumes that the steel situation is so critical that necessary mechanical protection to conductors must be dispensed with. This was undoubtedly the case when the order was written. It may still be. But just as soon as possible it ought to be amended to permit common trade practice to determine whether or not a raceway should be used and what kind should be installed.

Negotiated Contracts Proposed

F. W. Lord, founder of the Lord Electric Co. of New York, has long been a champion of the negotiated contract as an equitable, fair and dignified way for contractors to do business with the government. His persistence has carried his plan to Congress, where a bill will be introduced soon after the new session convenes.

The plan has been endorsed by a number of leading contractors, architects, financiers, labor leaders and public officials. It proposes to eliminate many of the evils of competitive price bidding and cost plus contracts on public work.

In essence, the proposed plan calls for contracts awarded on the basis of integrity, efficiency, experience, organization and other qualifications, the price arrived at by negotiation with a fixed profit ceiling. It has much to commend it to the serious study of all the construction industry.

The rigid laws which require the letting of all government work to the lowest bidder have certainly tended to eliminate consideration of elements far more important to the successful prosecution of the work than price. And they have stimulated collusion, price

fixing and other evils as frantic attempts to halt the ruinous course of uncontrolled price competition.

There should be a contract procedure available to public awarding authorities which can give proper weight to universally recognized business virtues. The negotiated contract plan may well point the way to a new level of ethics and new progress in the con-

Pennies Prove Costly Fuses

To prove his point emphatically and dramatically, Dr. Earl C. MacCracken of Teachers College, New York City, sent flames leaping from a fuse box in which pennies short-circuited the fuses. His audience was a class of 100 amateur home-repair instructors who had just completed a course in appliance maintenance. They are now on assignments around the metropolitan area, teaching housewives and high school students the art of keeping appliances in first class condition.

The fire demonstration was to emphasize how not to replace a fuse—by plugging it with a penny. Tucking a crumpled newspaper behind the conduit on the wall, Dr. MacCracken threw a short circuit on the line and in a few moments the paper burst into flame.

You can bet your bottom dollar those 100 amateur instructors will never forget that demonstration. Their vivid accounts of it to housewives and students whom they encounter on their assignments may do a lot to stop this all too common practice.

Employment Record

The excellent statistical analysis of the average working year developed by the Research Department of I.B.E.W. offers an unusually clear picture of the place of electrical work in the war program. Outlined in the Journal of Electrical Workers and Operators, the figures for 1942 show an average of 2211.8 manhours per worker, a 67.8 percent gain over the pre-war year 1939.

Full time employment, 52 weeks of 40 hours each, is 2080 hours. This is a standard seldom attained since practically every worker takes some time off during the year for sickness or vacation. Thus the 1942 average is well over the standard, indicating substantial overtime schedules, and a far cry from the depression year 1933 average of 515.4 hours for inside workers.

The figures given here omit the electrical utility workers included in the I.B.E.W. report since this class of work tends to follow a fairly level course independent of general business activity. The inside workers average hours per year exceeded the utility workers average in 1942 for the first time since the records have been compiled.

The sharp rise of average manhours in the war years is striking evidence of the enormous electrical job that has had to be done and the vital place of electrical construction in total war. With the great backlog of frozen construction waiting to be released it is more than likely that the postwar era will set equally impressive employment records.

Fire Prevention

Next month, October ninth, is the anniversary of the great Chicago fire of 1871. The calendar week including that date is set aside as Fire Prevention Week. And it is probably as good a time as any to stop for a while and contemplate the tremendous toll that fire takes every year in life and property. At the same time it is important to note that with all our care, fires of electrical origin still loom large in the statistics.

Over several years the average loss of life by fire has been about 10,000, a severe and preventable loss of manpower at a time when every hand is needed. Property losses average about $325 million, of which about 26 millions is attributed to electrical causes. Losses like these are difficult or impossible to replace in wartime. We are often tempted to consider fire statistics inevitable, yet individual carelessness or lack of foresight is the way fires start. The task of improvement, therefore, is at the individual level.

It adds up to a need for more forceful emphasis on all kinds of fire prevention activity. And, with us, every week ought to be fire prevention week.

We can't afford fires of electrical origin, especially in these times. A constant awareness of the potential hazards, a continuing program of public education and close cooperation with code and inspection authorities can help to prevent them.

Washington Comments

The drafting of fathers beginning in October is, of course, an effort to force 3A's into essential industries. Labor opposition to a National Service Act will probably continue to block the more direct approach to the manpower crisis. The new list of critical occupations is a sort of top priority, practically guaranteeing deferment if in an essential industry. The previous list of essential occupations still holds.

The curtailment of gasoline ration in the Middle West may give the East more but not much. Sold as a device for saving tires, it is now essential to make the available gas supplies go around. The consumption of petroleum products at the front is enormous and that's where the gas is going.

There are several small signs of a more liberal civilian goods policy, notably steel for farm machinery, wire for farms and parts for service industries. It is predicted that many more civilian shortages will be tackled as soon as peak war production is reached.

The government financed war facilities program was more than four-fifths completed by midyear '43 according to Donald M. Nelson. This compares with 61 percent at the beginning of the year and 34 percent a year ago.

Construction volume for the first five months of this year totalled $3 878,-243,000 as compared with $4,677,262,-000 for the corresponding 1942 period according to a WPB report. Extended through the half year the figures are 4.6 billions as against 5.9 billions or a 22 percent drop from last year.

A June total of 50,500 housing units for war workers completed carried the finished housing for the first half of 1942 to 281,500 units, an increase of 57 percent over the preceding six months according to National Housing Administrator John B. Blandford, Jr.

An amended CMP Regulation 4 sets up rules for warehouses and distributors to handle controlled materials from stock. Users of small quantities of steel can obtain their needs without allotments. Copper is more strict; after September 30 no warehouse can deliver wire except on an authorized controlled material order.

Prime contractors with backlogs of orders totalling 5 million dollars or more have been requested to place subcontracts in less critical labor supply areas. In effect this is the same policy followed in letting prime contracts.

UMI

BRIEF ARTICLES about practical methods of installing and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

PRACTICAL METHODS

DUCT FEEDERS CARRY DISTRIBUTION LOAD

WIRING

Totally enclosed bus duct was used extensively both for feeder purposes and branch circuit distribution in a Dayton, Ohio defense plant. The one exception was the short run of open type, ceiling mounted, L-V-D (low voltage drop) Buss-Wa tying in the transformer secondaries in the vault with the service breaker of the main switchboard in an adjacent room. Each individual copper bar of the open type duct is encased in an individual insulating sheath permitting close spacing for paralleling phase bars and eliminating the steel covers, thus reducing voltage drop and increasing the carrying-capacity of the system. However, where this duct entered the dead-front type switchboard a steel cover encased the busses.

Eight totally enclosed L-V-D Buss-Wa feeder ducts, each duct containing three individual circuits of 500 amperes each, leave the main switchboard and rise vertically to feed the manufacturing area on the floor above. Two runs of feeder duct each rise through the floor at four adjacent columns of a single bay, then branch out on the ceiling in radial fashion to feed numerous runs of Flex-A-Power with plug-in type outlets to serve the various machines in the area.

Beam clamps and rod supports were used to suspend the feeder and plug-in duct from the ceilings. Double angle iron strain brackets fastened to the twin duct risers rest on the floor openings, help support the risers and relieve some of the weight strain from the ceiling supports at these locations.

DUCT RISERS pierce floor at column locations, then branch out in radial fashion to feed plug-in type distribution duct serving machines. Feeder duct does not have plug-in feature.

DEAD FRONT SWITCHBOARD contains main circuit breakers and groups of 600 Ampere branch circuit breakers. Open type duct feeds board. Branch feeders are of totally enclosed low voltage type bus duct.

CABLE STRIPPER

INDUSTRIAL

When the government issued the directive that no more rubber insulation was to be burned from copper cable, that it was to be salvaged, Hugh B. Conover, chairman of the Maintenance Committee of Carnegie-Illinois Steel likewise issued an order to all maintenance superintendents of the various C.I.S. plants to devise some method for stripping. One of the best designs, we think, comes from John A. Morgan, supt. of maintenance at the Edgar Thomson works.

From scrap angle iron he built a small table top bench about four-feet high on which was mounted ¼-horsepower d.c. motor. The shaft of the motor is direct connected to a saw mandrel which carries a 6½-inch circular cutting blade supported by two ½-inch thick 4½-inch diameter steel plate washers. The outboard bearing is supported by a heavy angle piece bolted to the table top. A vee knurled roller is bearinged in two sliding blocks for vertical adjustment to accommodate various sized cable from No. 0 to 2,000,000 C.M.

Cable guides made from strap steel mounted on angle pieces are held by eight wing nuts. In this manner the guides can be adjusted up or down, in or out to accommodate the various size

NOTE TO HOME OWNERS

This means something to you, too. It foretells the day —not now, but after Victory—when you will have efficient fluorescent lighting in your own home.

The fluorescent fixture of the future

The new Sylvania industrial fluorescent fixture is much more than a design to save critical metal for armament.

Right now it is standardizing fluorescent lighting for precision production and is giving better cool, shadowless and glarefree light to war plants.

In its simplicity and flexibility of design, it is truly the fluorescent fixture of the future.

It takes its place on the list of Sylvania fluorescent "firsts" with the first complete industrial fixture, which did much to speed war production with the most efficient lighting known.

Sylvania engineers, who have contributed so much to the development of fluorescent lighting, streamlined this fixture and eliminated metal entirely from its reflector. Yet its durable composition reflector has an efficiency of 86 per cent, reflecting more light than prewar porcelain enameled metal in conventional contours.

This all-purpose Sylvania fluorescent fixture is designed to meet any industrial requirement in *one* of two standard sizes. It carries Underwriters' Laboratories approval and our own guarantee.

• • • **SYLVANIA ELECTRIC PRODUCTS INC.**

EXECUTIVE OFFICES: 500 FIFTH AVENUE, NEW YORK 18, N. Y.

INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, RADIO TUBES, ELECTRONIC DEVICES

UMI

cable. A sheet steel guard over the blade protects the operator from injury.

A three month collection of scrap cable which yielded a net of 200 pounds of rubber was disposed of by this stripper in less than half a day.

The government has since amended

J. A. MORGAN, supt. of maintenance and one of his foremen. E. J. Knight examine the clean stripping job done by the stripper which Morgan designed and built.

the rubber cable salvage directive to the effect that insulation can again be burned off, the reason being the need of copper scrap. Nevertheless, the stripper stands to exemplify attempts on the part of industry to cooperate wholeheartedly in the government scrap campaign.

CAPACITOR PLUGS IMPROVE POWER FACTOR

WIRING

One method of improving the power factor of an electrical distribution system is to install a bank of capacitors at the end of a long feeder to increase the capacity of that particular feeder. Another approved method is to install a single capacitor in the individual circuits of motors with low power factor. In fact, some manufacturers recommend placing the power factor correction units as near to the individual motor as practicable.

This latter scheme is the one that was used by the Marshalltown Electric Company, Marshalltown, Iowa, to improve power factor conditions in a midwest defense plant. Since the distribution system was of the enclosed bus type, it was only logical that capacitor plugs specifically designed for this system be used.

These units are used in place of an ordinary fused plug which offers no power factor corrective feature. Motor circuit conduits lead direct from the capacitor plug which is mounted to the busway system at the machine location. The rating of the capacitor depends upon the motor which it serves and the degree of correction necessary. Each capacitor plug is equipped with a small externally operated circuit breaker as a disconnect and protective device built in as an integral part of the unit.

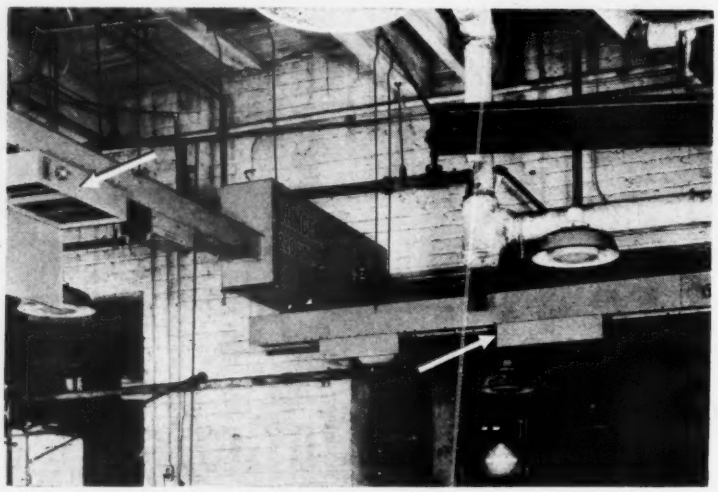
The system outlined above has one significant advantage over the "over-all" correction method. If, for any reason, a capacitor should fail on one low power factor motor, the system in general will not be penalized to as great an extent. Correction will be lost only to the specific motor which the plug serves.

AIR RAID LIGHT CONTROL

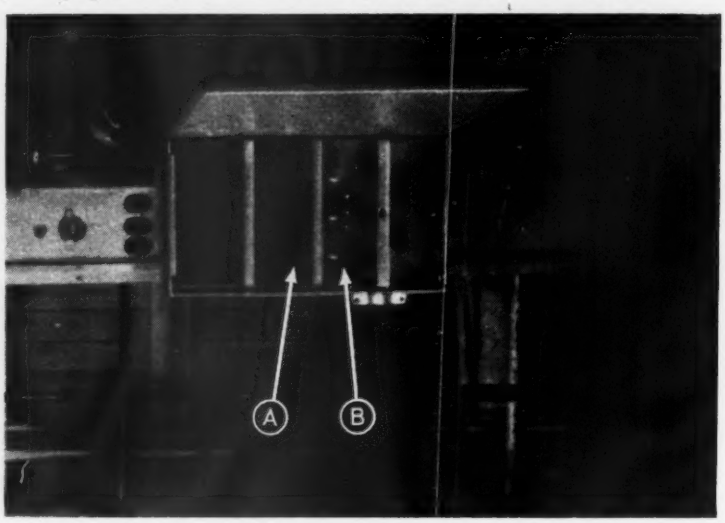
WIRING

Blackout orders require the extinguishing of all street lights at our Army post on the sounding of the red air raid signal alarm. Heretofore, this was accomplished by having a man stationed at the switch-house from dusk until dawn for the express purpose of pulling a switch to put the street lights out in the event the alarm for such action was given and operate the switch to turn lights on when proper signal was given.

The street lights are now being controlled by the telephone operator, who simply turns off or on a small toggle switch located on the side of the telephone switchboard. There is also a



***INDIVIDUAL CORRECTION** of low power factor motors is provided by capacitor plugs (arrows) mounted to sections of 1000 A. and 500 A. Flex-A-Power.*



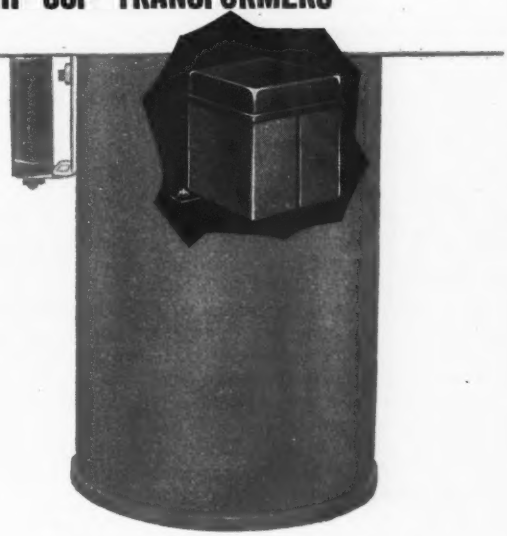
***WORM'S EYE VIEW** of the capacitor plug showing the capacitor (A) and circuit breaker (B) enclosed in a single metal case.*

ONE ANSWER

TO 3 QUESTIONS ABOUT TRANSFORMERS

1. How can heavier loads be handled?
2. How can this equipment be protected against loss?
3. How can service interruptions be reduced?

LOADING BY COPPER TEMPERATURE (L.C.T.) WITH CSP TRANSFORMERS



The answer to these questions is based on this fact: Loading by Copper Temperature (L.C.T.) increases usable transformer kv-a by 25% to 40% —with complete safety!

1 L.C.T. puts the reserve thermal capacity of a transformer to work. Emergency overloads can be carried longer, without danger, right up to the thermal limit of the windings.

2 L.C.T. gives sure protection against burnouts—positively disconnects a dangerous overload before windings can be damaged.

3 L.C.T. provides a visible indication of dangerous overload conditions so that load can be arranged, if necessary, to avoid power "blackouts."

Ask your Westinghouse engineer to give you the facts about this transformer development. He'll be glad to submit definite recommendations . . . glad to help you get more out of your transformer applications. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-70398

TRIPLE ACTION

FOR PROTECTING TRANSFORMERS

MEASURES **the amount of overload. Loading by Copper Temperature uses *actual* winding temperature, takes into consideration load duration and magnitude.**

SIGNALS **approach of thermal capacity. Unnecessary interruptions of service are avoided because a red warning light flashes when dangerous winding temperature is being approached.**

DISCONNECTS **load from transformer. If overload actually becomes dangerous, an internal circuit breaker *automatically* removes the load from the transformer.**

Westinghouse

PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

CSP TRANSFORMERS

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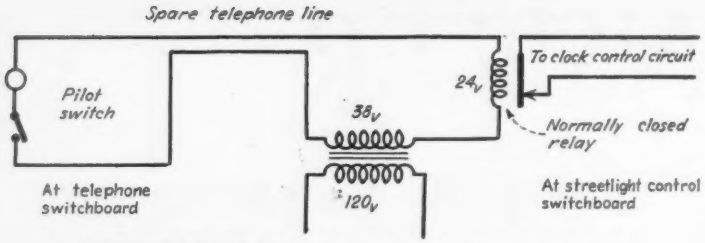


SIMPLIFIED DIAGRAM of telephone switchboard street light control.

small glow lamp incorporated with the switch for the purpose of indicating when the street lights are off.

This unique remote control system was installed by the Post Electrician, Sydney Stargatt, and has been in continuous service for the past twelve months having performed excellently during that period. A saving of man hours alone based on an 8-hour day for a period of one year would equal some 2,920 hours.

The total expenditure was $12 for material. Special parts—24 volt Cutler-Hammer enclosed relay, normally closed contacts, Bulletin No. 9575, Freed Transformer Primary 120 volt, Secondary 30–38 volt. Labor, 8 hours which would vary with the installation.

A pair of spare telephone wires running from a place located close to the source of supply, which consists of a constant current transformer controlled by an astronomical clock, directly to the telephone switchboard. One end of the wire was connected to a single pole toggle switch in series with a 3-inch Edison base receptacle and a 32 volt 15 watt bulb. The other end was connected to a single throw normally closed relay having a holding coil rated at 24 volts. The transformer to the holding coil has a variable tap from 28 volts to 38 volts. This is to compensate for the ohmic resistance line loss on the run of telephone wire.

The installation was made at a small initial cost in money and materials. A similar method of remote control on other street lighting systems would allow closer control of blackouts and a savings in man hours.

BRAKING BY PLUGGING

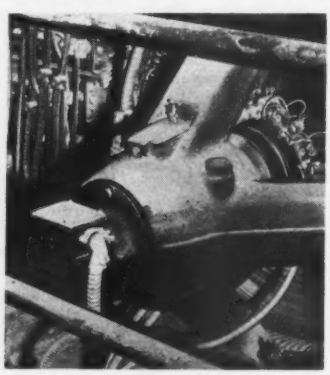
INDUSTRIAL

In the manufacture of rubber, huge heated rolls "work" the rubber until it is of such a consistency to allow it to be rolled out smoothly in thin sheets for final processing. The action is very similar to kneading dough in baking. The operator is continually cutting and peeling it from the roll, throwing it back n between the rolls for reworking. Since there is a certain amount of danger entailed in getting caught and drawn into the rolls, it is necessary that an instantaneous braking of some sort be provided.

Various forms of suitable braking is available, but C. E. Ross, Electrical Engineer of Hood Rubber Co., Watertown, Mass., prefers plugging of the wound rotor motors that are used for driving the rolls. Mounted just above the rolls are two long bars which when hit by the operator if and when he gets caught, will trip the main breaker. A bar is mounted on each side of the machine so that the operator can work on either side in safety.

As the operator trips the bar and, consequently, the main breaker, a second braking breaker operates inserting resistance (to limit current to a safe value) in the rotor circuit at the same time reversing the leads of the stator, which in turn reverses the rotation of the magnetic field. If left in this position the rotor would start in the reverse direction after coming to a full stop, but a plugging switch mounted on the shaft of the motor trips out the braking breaker as it attempts to reverse direction. The mechanism of the plugging switch rotates with the rotor shaft and when revolving in the proper direction regardless of the speed remains stable. However, upon reversal of rotation, the plugging switch operates killing the whole board and all circuits. Provision is made for another operator to open up the rolls in case one of the men gets a hand drawn into the rolls before he can trip out the motor.

The braking action is tested each morning to assure proper operation.



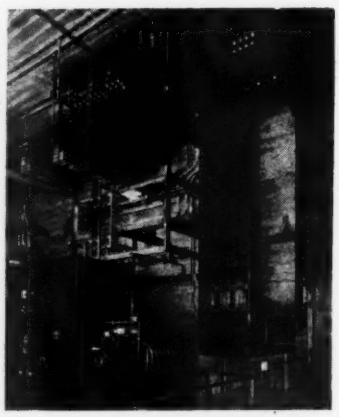
***THE MECHANISM** mounted on the rotor shaft is a plugging switch which disconnects the braking circuit as the rotor comes to a full stop and attempts to revolve in a reverse direction.*

OPEN BUSWAY FEEDS ELECTRIC FURNACES

WIRING

Electric feeders to electric furnaces in a Chicago defense plant consist of individual runs of open bus way suspended from the ceiling and mounted to the walls of the control equipment rooms.

The attendant photograph shows two runs of 5000 A. bus each capable of withstanding 100,000 ampere short circuit stress. Each run consists of as many as nine copper busbars per phase, encased in an open type heavy channel iron frame with welded angle iron reinforcing braces at strategic points along the length of the run.



***INSULATED BUS SYSTEM** of the open type carries heavy currents needed for electric furnace operation in this Chicago defense plant. Close spacing of parallel bars reduces voltage drop and open construction increases carrying capacity of system.*

Each copper bar is encased in an individual insulating sheath, permitting close spacing per phase and eliminating the necessity of enclosing steel covers. This feature reduces voltage drop and increases the over-all carrying capacity of the system.

Ceiling suspension is provided by numerous heavy bolt rods fastened to ceiling inserts and passing through the flanges of the channel bus frame. Bare copper bars on insulated supports tie the bus system to control equipment.

Kelso-Burnett-Fries-Walters of Chicago were the joint venturer electrical contractors on the project.

Electrical Contractors...

THIS FREE WALL CHART

WILL DEVELOP NEW BUSINESS

This 22" x 33" wall chart tells how to make electrical wires and cables last longer. It also provides some hints on HOW TO DEVELOP NEW BUSINESS. Use it to sell your industrial customers on employing your services for improving circuit capacities and efficiencies. Show them how you can increase cable life, without purchasing new equipment, by merely moving cables from a hot to a cool location, or by installing a fan or a simple baffle, etc.

The chart also has suggestions on cable maintenance — an industrial job you can profitably undertake when new work is hard to obtain.

Send for a copy today and put it to work for you. . . . The Okonite Company, Passaic, New Jersey, and Hazard Insulated Wire Works Division.

How to Get Extra Life and Efficiency From Electrical Wires and Cables
THE OKONITE COMPANY
This chart tells you:
• How to increase current loadings (nearly half the suggestions are on this subject).
• How to protect joints.
• How to prevent damage to cables.
• How to care for portable cords.
• How to store insulated wire.

3369

ARMY E NAVY

HAZARD Insulated Wires and Cables

NOW Is The Time To Check Your Lighting

Now . . . before the dark winter days increase your dependence upon good lighting . . . is the time to check your lighting system and the maintenance methods employed to keep it at peak efficiency.

As a war plant you will be able to obtain the necessary Benjamin equipment to make improvements in your lighting system such as are outlined below.

Benjamin *Illumineering* Insures Proper Lighting of the Seeing Tasks in Your Plant

Benjamin *Illumineering* is one of the important Benjamin services which is helping America's War Industries to secure the right kind of lighting to conserve employees health and energy, reduce accidents and increase production.

Benjamin *Illumineering* gives you the assurance that the lighting units recommended are correct in design and are properly selected and installed to meet the requirements of the specific seeing tasks from the viewpoint of Sufficient Light, Quality of Lighting, Light Distribution, Light Diffusion, Light Control and Shielding.

Write today for a copy of the Benjamin booklet:

"Productive Lighting for War Plants"

outlining procedure for checking lighting conditions in your plant and giving specific data on how to solve many lighting problems common to industrial operation. It will be sent to you without cost or obligation.

7 WAYS TO USE BENJAMIN LIGHTING EQUIPMENT

For Lighting Improvement and Lighting Equipment Maintenance

1 PROVIDE MORE LIGHT

Production experience often reveals the need for more light for certain operations, especially where detail is fine, for inspection, etc. such as is provided by Benjamin Fluorescent units.

2 INCREASE SAFETY

National Safety Council estimates 15% to 25% of industrial accidents are traceable to inadequate lighting. Machines, passageways, stairways and other areas should be checked and proper lighting provided.

3 REDUCE MAINTENANCE TIME

Dust and dirt on lighting reflectors can waste 50% and more of the light. Considerable time can be saved and constant lighting efficiency more easily assured in dusty and dirty locations by equipping units with Benjamin Dust-Tight Covers or use of enclosed lamp units such as the Glassteel Diffuser, Dust-Tight Units, etc.

4 IMPROVE PLANT PROTECTION

Get Benjamin recommendations for providing a protective fence of light around your plant and grounds. Or for improving your outdoor floodlighting for protection against sabotage and illegal entry. The new Benjamin Floodlighting Projector Type RDS and other units are available for this purpose.

5 REDUCE FIRE HAZARDS

Where explosive vapors or explosive dusts are present in the atmosphere, absolute protection against fire or explosion from the lighting equipment can be obtained through the installation of Benjamin Explosion-Proof and Dust-Tight Units.

6 SPEED NIGHT YARD WORK

The better lighting provided by Benjamin special outdoor lighting units for loading platforms, work areas, stock piles, etc. enables men to work faster, surer and more safely. Get Benjamin recommendations and lighting layouts for such areas.

7 MAINTAIN LIGHTING LEVELS

Keep your lighting system in full operation at all times by making repairs when needed to secure the maximum benefits of a good lighting system. Replace burned out and blackened lamps, worn out or damaged sockets, reflectors and other parts, so that the levels of lighting will be maintained on a constant basis. Benjamin lighting maintenance items are available for this purpose.

BENJAMIN ELECTRIC MFG. CO., Dept. H, Des Plaines, Illinois

BENJAMIN TRADE MARK

Lighting Equipment

Matched Motoring Reduces Operating Costs—I

The first of two articles showing how maintenance and operating costs can be reduced by reapplication of motor drive to raise plant power factor through closer loading.

MANAGEMENT is full of praise for the individual or department that can find ways of reducing costs. Management quite naturally thinks in terms of figures—dollars and cents. A dollar saved is another dollar that can be divided into wages, taxes, dividends and reduced commodity costs. In the era to follow with renegotiation, heavy taxation and smaller percentage margins, these cost reductions may mean the difference between accounting with red or black ink.

Much emphasis has been placed upon power factor improvement. Contributing factors for this emphasis can be traced to two major sources. First of all the utility has entered clauses into their rate agreements whereby, for example, the consumer must pay a penalty of so many dollars for each percent his power factor falls below eighty-five percent on peak, and conversely is credited a premium for each percent above eighty-five on peak. Secondly, steps to improve power factor can often relieve overloaded transformers and feeders. Delays in obtaining allocations or priorities for new bus, cable or transformers, in addition to the long deliveries entailed, has forced the capacity use of existing equipment.

The War Production Board several months ago asked manufacturers to redesign their motors so that, for example, a 50 hp. motor would be good for a continuous 50 hp. load and not for 57.5 horsepower as presently designed. In other words, the idea was to save that extra steel and copper which has been built into the motor as a safety factor to provide extra capacity for emergency and added length of life. However, the manufacturers have found a much better solution in rerating motors, and have thus obviated the necessity for scrapping present standards that represent many years of research and engineering practice. Although it is not considered good peacetime practice to knowingly apply continuous overload to a motor, it has become a wartime necessity. However, our concern of underloaded motors should be as great as that of overloaded motors. Too often a safety factor much too large is applied in determining a motor rating for a given load. This is uneconomical practice not only in consideration of the first cost investment but also of the operating cost. Underloaded motors operate at lower efficiencies and very much lower power factors. But beyond this, the life of the average motor in 90 percent of the cases carry it into obsolescence representing added waste. As a manufacturing executive put it recently "the electric motor is too damn good, it becomes obsolete before it even half wears out."

Effect of Underloading

At a recent conference on conservation of critical materials, where the recommendations were made for rerating motors, it was pointed out by industrial men present that a very large percentage of the installed motor load in industrial plants operate *below* 50 percent nameplate rating. If this is true, then it can be safely said that a much greater saving of critical material can be realized through the re-application of existing motors, than can ever be effected in the rerating of new motor installations. One need only compare the millions of motors already in use to the few thousand which will be installed under the rerating recommendations.

As an example of what effect underloading has on power factors and efficiencies, the accompanying charts have been included. They both represent the purely hypothetical case where the sequences of motors from 5 hp. to 200 hp. are found to be respectively 50 percent and 30 percent loaded. It is to be remembered that this group of industrial and maintenance engineers, and electricians have admitted that a large percentage of their own plant motors are normally operated (on the average) at 50 percent or below. One maintenance engineer claimed that by following a reapplication program of closer motor to load rating, he had raised his plant's power factor by 20 percent. He did this before the utility put a power factor clause in his company's contract and they are now realizing handsome dividends in the form of premiums because of his farsightedness. In addition, he has kept down his feeder and transformer loading, and released feeder and transformer capacity to additional loads.

In a recent survey of a glass plant load it was found that the average motor load was 35 percent of full rating. A line of 15 hp. compressor motors were each pulling only 5.5 hp. A 25 hp. glass crusher motor was pulling only 2½ hp.,

and was claimed to have been selected because of starting difficulties, even though started only once or twice a day, running almost continuously. Various sized batch-mixing motors were only 30 percent loaded. The one motor which was operating near the full load point was a vertical deep-well turbine motor and it was overloaded 15 percent. This load was entirely direct current fed by engine-driven generators. Had this been an a.c. load, chances are their station power factor would have ranged around 45 percent to 55 percent.

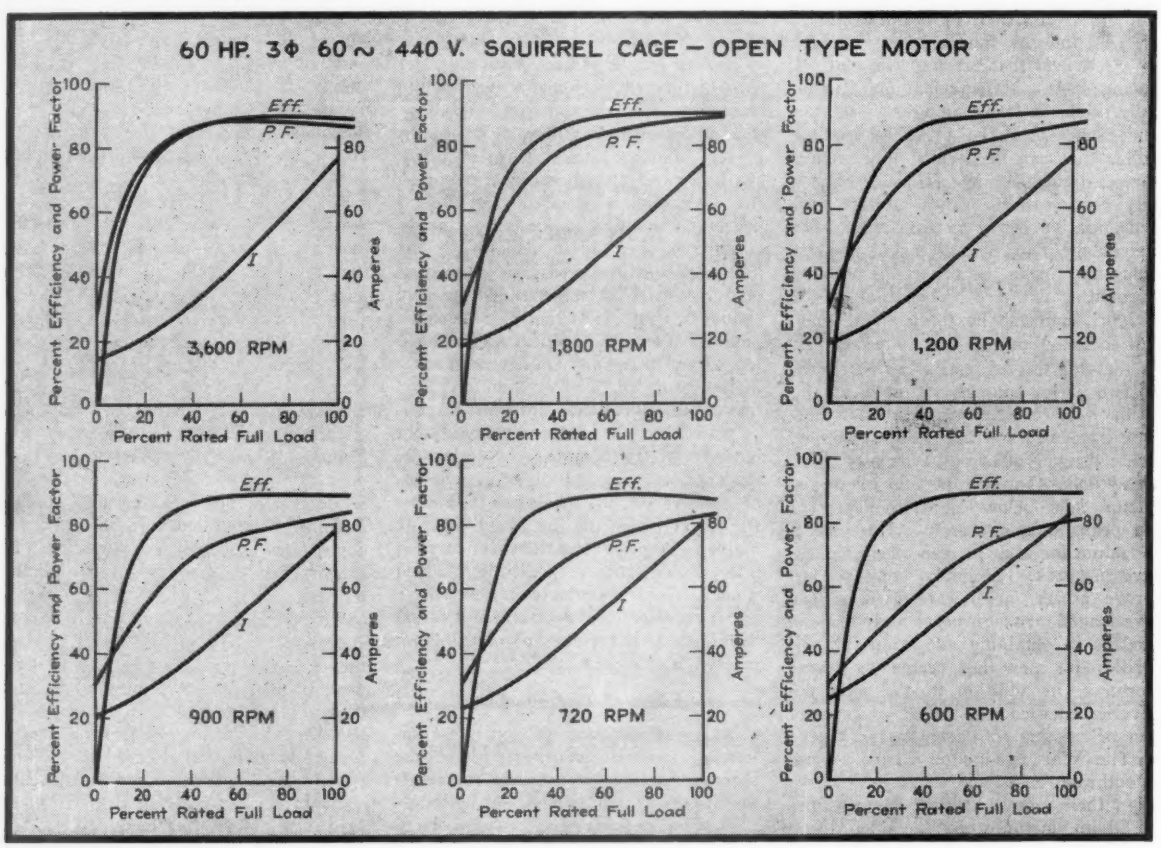
The accompanying bar graphs will give a visual picture of how a re-application of motor drive can relieve system loading. The first column gives the horsepower required by the connected load. Opposite each of these figures are two bars; the first representing the kva. input to the motor which closely matches this load, and the second representing the kva. input to the larger motor which is now driving that load. The heavily shaded portion represents that kva. which can be saved by using a smaller motor which matches more nearly the load requirements. The upper graph depicts the case where the present driving motors are only 50 percent loaded; while the lower graph shows the case where the present motors are only 30 percent loaded. This is, of course, a purely hypothetical case, and undoubtedly such a sequence does not exist in your plant, but after a careful study of your own plant conditions many opportunities for interchange or a general move up will be seen. Unusual circumstances alter some cases. In certain instances torque requirements or wide load variations necessitate the use of a larger motor, but these cases are few.

Typical Charts

The actual time and horsepower measurements taken by Warner and Swasey, machine tool manufacturers, gives a typical machine tool requirement. Although a 15 hp. motor was specified by the customer, a 7.5 hp. motor could walk away with the particular job. A 225 percent pull out torque would easily carry the peaks and the 15 percent service factor built into almost every motor would allow sufficient heat dissipation to carry the momentary overloads. Suppose momentary overloading does heat up the motor 5° or 10°. Insulation life may be cut in half. Now it will only last 10 or 15 years instead of 20 or 30 years. But at the rate of present progress it will be obsolete then anyway. Furthermore, the critical material cannot be wasted now in oversize motors. Delivery dates on postwar motors will be much better than they are today; the motor will be better, too.

A set of efficiency and power factor curves have been included for a series of 60 hp., 3 phase, 60 cycle, open-type, general purpose, squirrel cage motors at speeds ranging from 600 r.p.m. to 3600 r.p.m. As the selected motor synchronous speed is reduced from 3600 r.p.m. the power factor curve drops considerably at each step. It is on this basis that higher speed applications are always recommended. Where a change of pulleys is possible in order that a higher speed motor may be used, it is wise to investigate stock for an available motor to replace the drive.

Since one of the purposes of this article is to discuss the relief of feeder loading, two further steps, in addition to



POWER FACTOR, EFFICIENCY AND CURRENT CURVES are plotted from test data on a 60 hp. squirrel-cage motor for synchronous speeds from 3600 r.p.m. to 600 r.p.m. Note how the power factor curve drops for each lower speed motor while the current curve increases. For this reason, a higher speed motor is generally recommended providing pulley ratios are adaptable.

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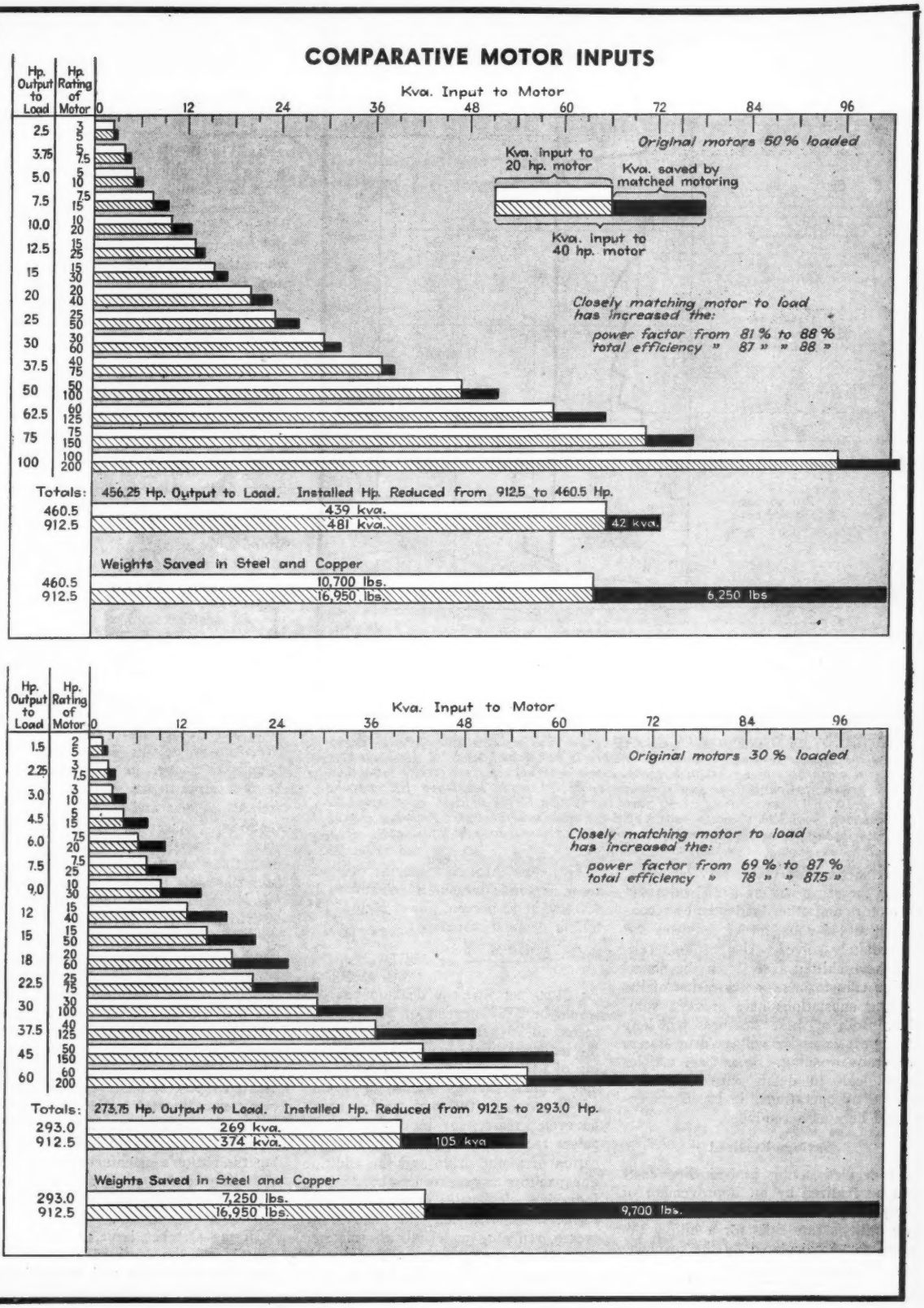
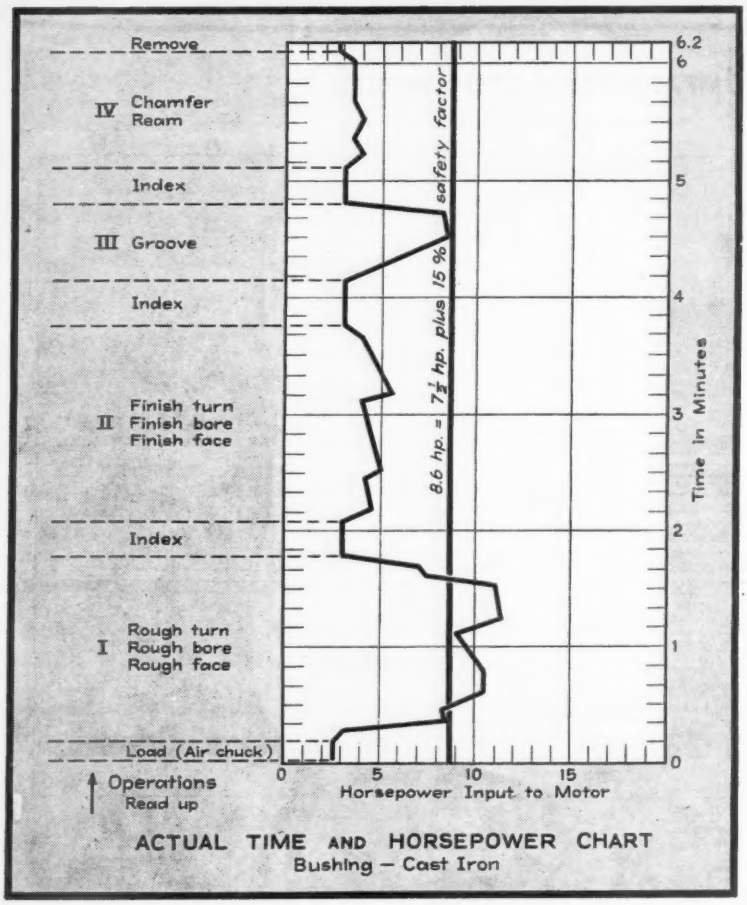

COMPARATIVE MOTOR INPUTS
Hp. Output to Load
Hp. Rating of Motor
Kva. Input to Motor
0
12
24
36
48
60
72
84
96
Original motors 50% loaded
Kva. input to 20 hp. motor
Kva. saved by matched motoring
Kva. input to 40 hp. motor
Closely matching motor to load has increased the:
power factor from 81% to 88%
total efficiency " 87 " " 88 "
2.5 3 5
3.75 5 7.5
5.0 5 10
7.5 7.5 15
10.0 10 20
12.5 15 25
15 15 30
20 20 40
25 25 50
30 30 60
37.5 40 75
50 50 100
62.5 60 125
75 75 150
100 100 200
Totals: 456.25 Hp. Output to Load. Installed Hp. Reduced from 912.5 to 460.5 Hp.
460.5 439 kva.
912.5 481 kva. 42 kva.
Weights Saved in Steel and Copper
460.5 10,700 lbs.
912.5 16,950 lbs. 6,250 lbs
Hp. Output to Load
Hp. Rating of Motor
Kva. Input to Motor
0
12
24
36
48
60
72
84
96
Original motors 30% loaded
Closely matching motor to load has increased the:
power factor from 69% to 87%
total efficiency " 78 " " 87.5 "
1.5 2 5
2.25 3 7.5
3.0 3 10
4.5 5 15
6.0 7.5 20
7.5 7.5 25
9.0 10 30
12 15 40
15 15 50
18 20 60
22.5 25 75
30 30 100
37.5 40 125
45 50 150
60 60 200
Totals: 273.75 Hp. Output to Load. Installed Hp. Reduced from 912.5 to 293.0 Hp.
293.0 269 kva.
912.5 374 kva. 105 kva
Weights Saved in Steel and Copper
293.0 7,250 lbs.
912.5 16,950 lbs. 9,700 lbs.



ACTUAL TIME HORSEPOWER CHART of a typical machine tool operation shows why the average loading of industrial motors is below half load. A 15 hp. motor is used on this machine whereas a 7½ hp. motor with a 15 percent service factor and 225 percent pullout torque could easily handle the load. Insulation life may be cut to 10 or 15 years instead of 30 years but in that length of time what would be the saving in dollars from increased efficiency and power factor? Probably enough to buy five or six new motors where rate structures include p.f. clauses.

power factor correction, may be made. If the operating voltage is 220 volts and all motors and other loads can be reconnected to 440 volts, feeder problems are immediately solved. Also, if load centers have shifted away from the distribution transformers, a relocation of the feeding substations may prove a solution. Both of these measures will help to correct excessive voltage drop due to feeder overloading. Since past articles have dealt in detail with these two phases of operations, it is only mentioned here as a reminder.

Savings Realized

A decided saving in operating costs can be realized by an improvement of the plant power factor. As an example, one utility's rate calls for a billing demand to be calculated by the formula:

$$\frac{\text{measured demand}}{\text{power factor}} \times .95$$

To follow through a specific case, assume a plant's measured demand to be 450 kw. at 65 percent power factor. The billing demand would be

$$\frac{450 \times .95}{.65} \text{ or } 658 \text{ kw.}$$

At $1.50 per kw. the demand charges would be $987 instead of $675 if corrected to 95 percent power factor. Or the industrial plant would realize a saving of $312 per month on demand costs. The annual savings would amount to $3744. Actually the total savings would be even greater, for in correcting the power factor to 95 percent by re-application of motor drive and the addition of capacitors or synchronous condensers, individual efficiencies of motors, transformers, feeders, etc., will likewise increase, reducing materially the metered demand and energy consumption.

Savings such as this are typical. It is important that a check be made in your plant if only to satisfy your own curiosity as to what the power factor actually is and what load is contributing most.

The saving of steel and copper weights referred to in the charts will be considered by some not to be an actually realized saving. However, this saving will be realized when the larger motors, released by smaller ones, can be applied to new loads which would otherwise require new motors. In addition, an immediate saving will be realized in feeder wire and cable, switch and panelboards and transformers. In almost every case where the installation of new copper and steel for this equipment is being contemplated to supplement existing overloaded equipment, a decided increase of power factor will obviate the installation.

As an example of the conservation of additional weight referred to, a short 400-foot, 3 phase, 440 volt, 2/0 trunk feeder is carrying 111.5 kw. at 65 percent power factor. This means that the feeder is carrying 171.5 kva. at 225 amps. If the power factor of the load is raised to 85 percent retaining the same delivered load of 111.5 kw., the kva. would be reduced to 131.2 kva., a saving of 40.3 kva. with a reduction in current of 53 amps. The feeders and transformers, which previously could not have carried another ampere without excessive overheating, have now enough released capacity to carry a 40 hp. motor or five 7½ hp. motors fully loaded. In other words, the carrying capacity has been increased by 23½ percent. If an additional feeder were required to deliver power to this 40 hp. load, 100 pounds of copper in wire alone would be necessary, to say nothing of added weights of steel and copper in conduits, raceways, connectors, fuses, disconnects, switches, transformer capacity, etc. Further, this "wasted" current is reflected back through transformers and transmission lines, where additional weights of critical material must be provided by the utility to transmit this current. As can be seen in this one small instance a very great amount of critical material is being wasted to transform and transmit this useless current. On a nationwide scale this waste amounts to thousands of tons. Here is certainly a situation that can be remedied. A wholehearted "power factor campaign" by every maintenance organization in industry is the answer. Maintenance is already doing a magnificient job in keeping the nation's machinery in top-notch operating condition. It can do a much bigger, better and more vital job in the conservation program.

In the October issue, a definite approach will be outlined as to exactly how this correction and re-application program can be carried out.

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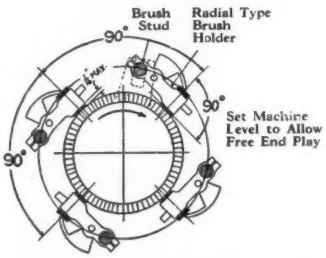
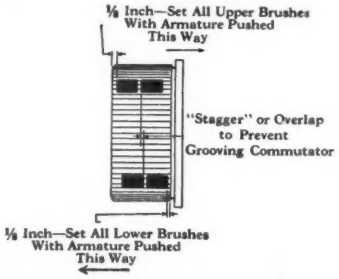
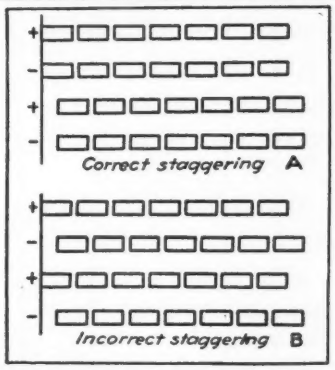
ELECTRICAL CONTRACTING DATA SHEET M-1

Brush and Commutator Maintenance

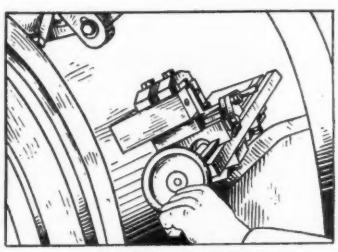
How to Set Radial Type Brushholders To Prevent Injury to Brushes and Commutators



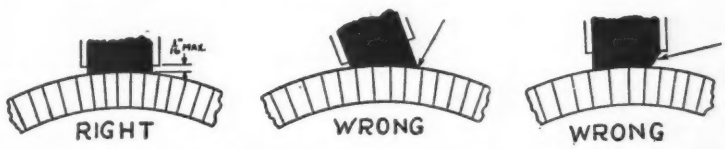

⅛ Inch—Set All Upper Brushes With Armature Pushed This Way
"Stagger" or Overlap to Prevent Grooving Commutator
⅛ Inch—Set All Lower Brushes With Armature Pushed This Way



Precision Grinding and Adjusting Studs and Brushholders



Precision Grinding



Brushholder 1/16 inch. maximum from commutator.

Brush stud too close or too far from commutator.

Brushholder too far from commutator.

Where brush tips break, the contact area is reduced with consequent burning. Poor brush seating also reduces contact area and causes burning.

Troubles	Remedies
Rough, ridged or filmy commutator	Use a precision grinder which mounts directly on the brush arms or frame to do the grinding at normal operating speeds under the machine's own power. Grinds to an accuracy of .001 inch. Or use several of a series of grades of resurfacing stones available from extra coarse to polish. Re-seat brushes with a brush seater or concaver. Clean the slots between the commutator bars if the insulation is undercut.
High or low bars or eccentric	Can be detected by measurements or distinct knocking when a finger is pressed on the brushes. Tighten commutator ring while commutator is hot. Turn the commutator in a lathe at high speed using a sharp pointed lathe tool. Undercut mica between slots if originally undercut. Undercut should be as deep as mica is thick but not over 1/16 inch. Can be done with undercutter, various slotting files and scrapers, or with a coarse hacksaw blade with set removed by grinding the sides of the saw on a stone. Polish commutator with polishing stone.
Poor contact between brush and commutator from insufficient spring tension	Tighten the springs and oil the brush finger bearing with thin oil. Renew the spring if it has lost its tension. Check brush spring tension on a machine with four brush studs while operating under normal load. Lift all brushes on one stud from the commutator and if the opposite brushes spark badly tighten the spring tension on these brushes. Make this test at all four studs. Brushholders should be free from dirt so that brushes move freely and commutator should be in good condition when this test is made.
Poor contact — dirty holder	Clean the brush and holder thoroughly, using kerosene if necessary. Brushes must move freely in holder.
Brushes not properly seated	Re-seat brushes with a brush seater or concaver. A perfect fit is very important. If possible, allow machine to run several hours at no load to polish the commutator and brush faces after seating.
Worn out brushes	Replace and seat according to instructions above. Use only the make and grade of brushes recommended by the manufacturer of the machine. Trouble may result from use of wrong brushes.
Brush chatter	Wrong angle contact from brush stud being set too close or too far from commutator. Reset stud and adjust brush holders as above. Re-seat brushes (see above). Insufficient spring tension (see above). Dirty holder (see above). Brush worn out, not properly seated or wrong grade (see above). Holder too far from commutator (see diagram).
Sparking and burning tips	Proper brush yoke position is marked on the yoke and hub of the end bracket, or indicated on the yoke by an index finger. Setting should not be changed unless all other remedies fail. Yoke may be moved 1/16 inch either way from factory mark whichever way proves best.
Grooved commutator	Commutator should be machined, undercut and polished as explained above. Brushes should be staggered as in diagram above. If armature end play is too great for proper staggering, use fiber washers on shaft to reduce it. Top brushes go to the outside and bottom brushes to the inside end of the commutator. Bottom of brushholder should be no more than 1/16 inch from commutator.

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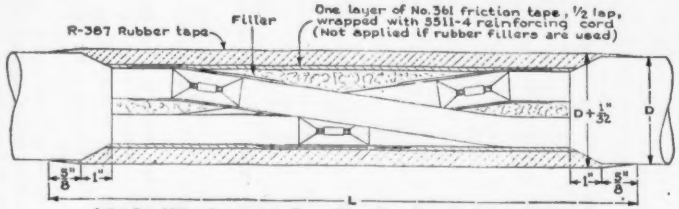
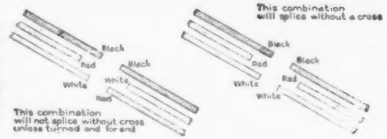
How To Splice Portable Cable

Proper repair of a cable after failure is extremely important and must be done properly to prevent a re-occurrence. Molding equipment, recommended for splicing rubber jacketed portable cable, will make a splice the equal of original cable insulation.

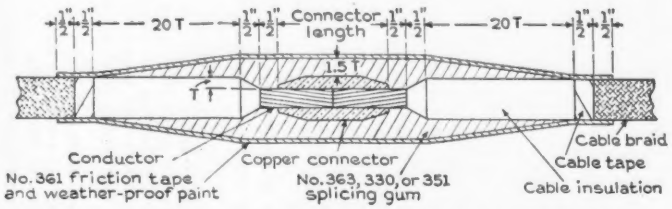


Joint for 600-volt portable Type W cable, showing the staggering of individual splices.

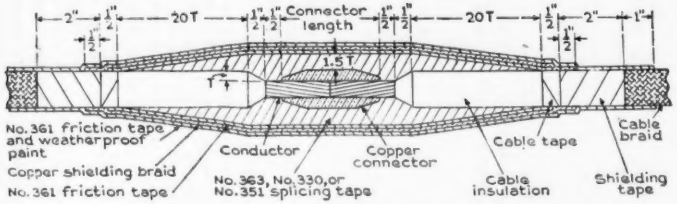
In all portable-cable joints, it is advisable to make the joint so that the overall dimensions conform as closely as possible to the dimensions of the cable. If there is a cross in the joint, the joint will have to be larger than usual. A cross can be avoided if the cable is turned end for end, as shown in the diagram.


This combination will splice without a cross
Black
Red
White
This combination will not splice without cross unless turned end for end

Three Conductor Joint

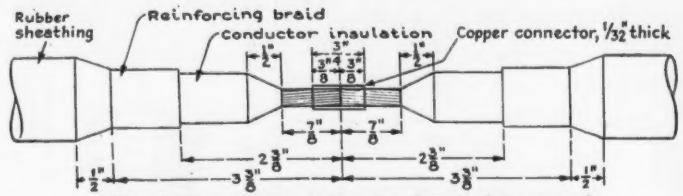


Braided Rubber Insulated Nonshielded Power Cable



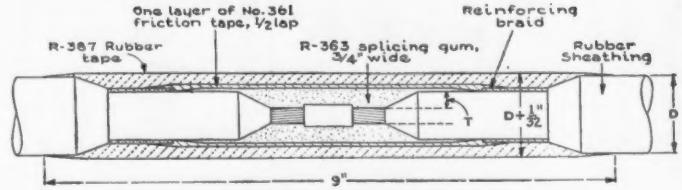
Braided Rubber Insulated Shielded Power Cable

Sketches courtesy General Electric Co.



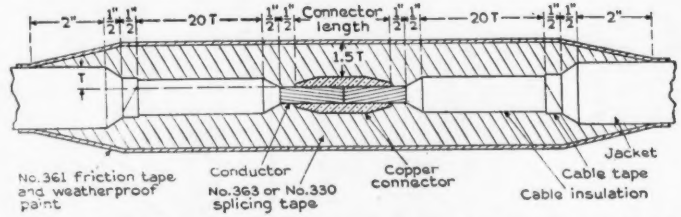
Rubber sheathing, reinforcing braid, and conductor insulation removed, and conductor insulation penciled.

Copper connector assembled and rubber sheathing penciled.



Splice completed with splicing gum, friction tape, and rubber tape applied. The joint should now be vulcanized.

Single Conductor Joint



Rubber Jacketed Single Conductor Nonshielded Power Cable

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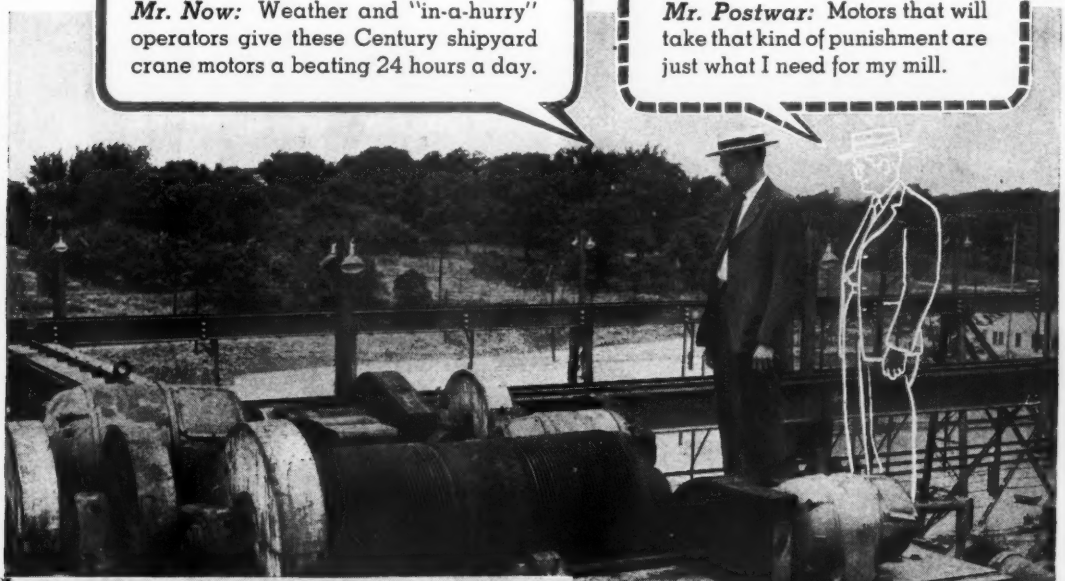

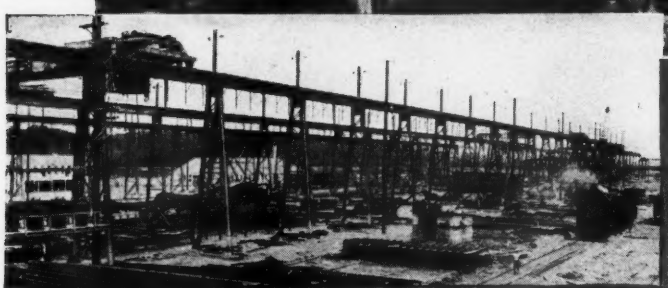

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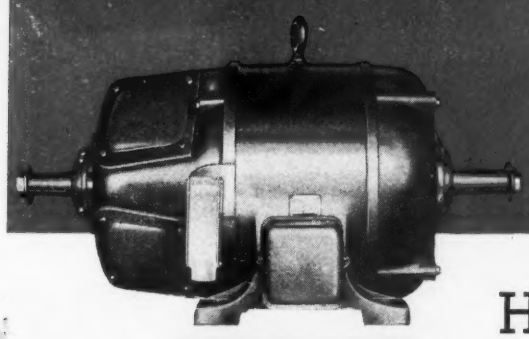

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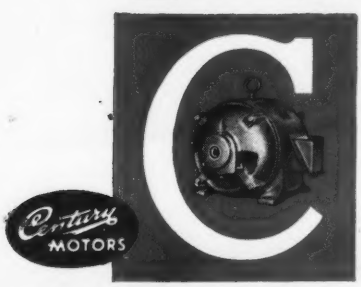

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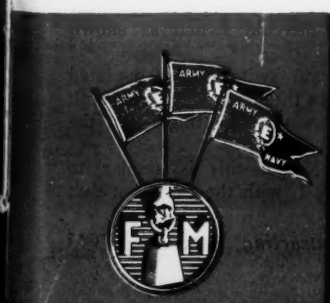

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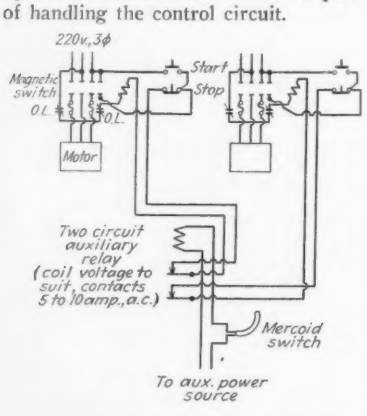
READER'S QUIZ

DISCONNECTING TWO MOTORS

QUESTION 106. Having two magnetic switches for two 7½ hp., 220-volt 3-phase motors, what wiring would you make to aid in the protection of a mercoid single pole switch that would disconnect both motors? Both starters have one starting-stop station.—W.J.L.

A. TO QUESTION 106. If the interpretation of the problem is correct, there are two motors, two starters, two pushbutton control stations, and one mercoid switch.

One solution would be to install an additional magnetic starter common to both motors. This would be placed ahead of the existing disconnecting switches for the individual motors. For control, the mercoid switch and a conventional open-contact motor starting pushbutton station would be used. The mercoid switch would serve as the usual stop switch. This would require a 15 hp. starter and a mercoid switch capable of handling the control circuit.

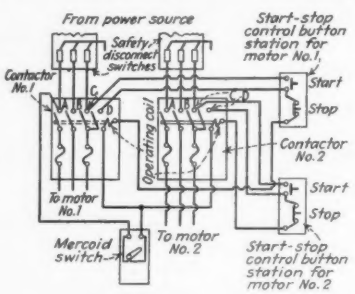


A less expensive way would be to use a two-circuit auxiliary relay. These can be purchased for a variety of coil voltages. The mercoid switch would be in series with the relay coil and connected to a power source which will be within the allowable limits of the mercoid switch. Each contact of the relay would be wired in series with one of the existing stop switches.

This arrangement will allow each motor to be started and stopped independently of the other. If the mercoid switch opens, both motors will stop and cannot be started until the switch has been closed.

The contacts of the relay must be so arranged that they are closed only when the coil is energized. The auxiliary power source may be from a battery, a lighting circuit, or a low voltage transformer.—L.E.B.

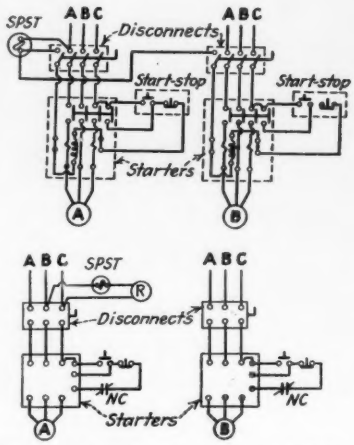
A. TO QUESTION 106. From this question it appears that there are two 7½ horse-power, 220-volt, 3-phase motors, each provided with a magnetic switch or contactor and each controlled from a single start-stop pushbutton station. The question is as to how to connect a mercoid single pole switch to provide additional protection and stop both motors in case of trouble.



The contact of the mercoid switch should be placed in a common wire connecting from the power to the operating coils of the two contractors. The accompanying sketch shows the connections.

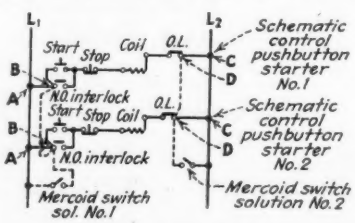
When mercoid switch contact is open the main contactors will open. The contactors cannot be closed nor the motors started till the mercoid switch is closed.—J.E.W.

A. TO QUESTION 106. Reconnect one leg of the starter control circuits so that both starters receive their supply from a common source and add the s.p.s.t. switch in this leg. The disconnect switches should have 4 blades so that each starter will be "dead" when its disconnect switch is pulled.



Another method makes use of an auxiliary relay (R) with two normally closed contacts. (NC).—R.J.B.

A. TO QUESTION 106. There are two solutions to W.J.L.'s problem of providing safety to two motors by having a mercoid switch so connected that on operation it will stop both motors. A schematic drawing is shown of the two magnetic starters.



Solution No. 1—requires the removal of wires AB on both starters. Connect points BB as shown dotted. Connect point B to mercoid switch as shown dotted.

The mercoid switch when operated will then open the control circuit to both motor starters thus shutting down the motors.

Solution No. 2—this is similar to Solution No. 1, with the exception that

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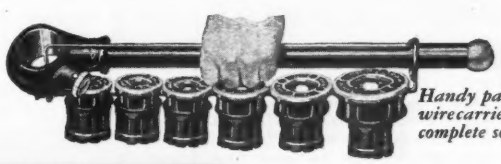

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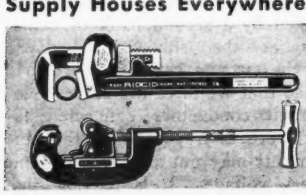

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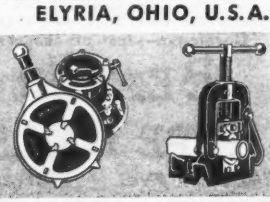

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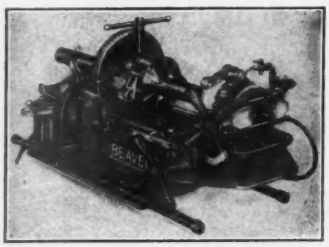

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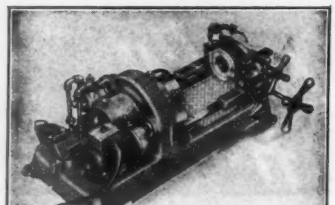
Write for Bulletin A



Beaver Model-B
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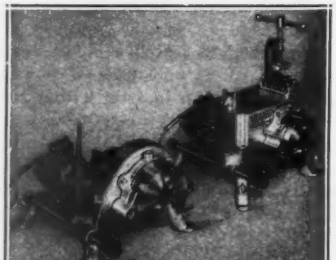

Beaver Model-C
A STURDY LITTLE POWER UNIT Converts hand pipe tools into power tools from 1/4 to 8-inch. Threads 8-inch in 6 minutes. Threads bolts up to 1 1/2-inch. Two men can work at the same time without interference. Weight 150 lbs.
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the mercoid switch is connected in the other side of the control circuit line, to make this connection remove wires CD on both starters. Connect points DD as shown dotted. Connect point D to mercoid switch as shown in Solution No. 2.

It might be that due to local conditions that a combination Solution No. 1 and No. 2 would be best. This would mean merely operating the starters on a common set of control wires, and could be done by following the direction for Solutions both No. 1 and No. 2, by making a solid connection in the place of one of the mercoid switches.—M.A.H.

CONNECTING LINES IN PARALLEL

QUESTION 107. In order not to halt our power supply, we used a line phasing tester before interconnecting two circuits of 4160 volts four wire three phase. The new circuit came direct from the main power plant, and the old circuit, which came from a substation served from the main power plant was to be removed. Carefully phasing out each hot leg we made the interconnections, which tied both circuits in parallel. A few minutes after making our last hot line connections the insulation started to heat up. What caused this?—W.H.L.

A. TO QUESTION 107. Heating up of the insulation indicates a current circulating in the loop: power plant—new circuit—interconnection—old circuit—substation—old circuit—power plant. The magnitude of this current is, according to Ohm's law, given by the voltage difference between corresponding phases at point of interconnection, prior to connecting the loop impedance. Assuming proper phasing, as stated by the inquirer, the voltage difference can be caused by either one of the following two reasons, or both together.

1. The voltage to neutral of corresponding phases is different. For instance, the voltage between phase A (new line) and zero is greater than the voltage between phase A′ (old line) and zero.

2. The voltage to neutral, of corresponding phases, is the same but they have a phase displacement in time.

To investigate this matter, measure the voltage between corresponding phases and ground, and between the phases themselves. Obtain, as an example, A to ground = 2400 volts, A′ to ground = 2350 volts, A — A′ = 100 volts. Were there no phase displacement, A — A′ would be 2400 — 2350 = 50 volts. As the difference is 100 volts, one has unequal line-to-ground voltage, plus a phase displacement.

Now, this voltage difference does not operate on motors, transformers, or similar devices developing "counter-EMF's" but on the loop impedance that is, so to speak, on the rather low ohm value of a short-circuited line. For that reason, a comparatively small voltage difference is sufficient to produce a high circulating current which in turn heats up the copper and the insulation.—L.F.R.

A. TO QUESTION 107. To operate efficiently in parallel, transformer banks must have the same ratio of transformation and the same ratio of resistance to reactance. Any other condition will set up internal voltage differences which will cause a circulating current to flow. The value of the circulating current depends upon the voltage difference of the transformers and the impedance of the circuit. This circulating current between the transformer banks plus the load current already being carried by the transformers could cause the heating mentioned and would limit the load which could be carried.

Suggestions are (1) recheck the ratios of the two banks, changing taps if necessary, and (2) recheck connections to make sure that polarity is correct. Nothing can be done to adjust the impedance unless external reactors and resistors were installed.

Sometimes, two of the hot legs are properly phased out and the third one is assumed to be correct when it really is reversed. This would cause a short-circuit in one branch, the current being limited only by the impedance.—L.E.B.

A. TO QUESTION 107. The information given is not absolutely clear as to the characteristics of the two circuits. For this reason certain additional assumptions are being made in attempting to explain the difficulty encountered. Two conditions are being considered.

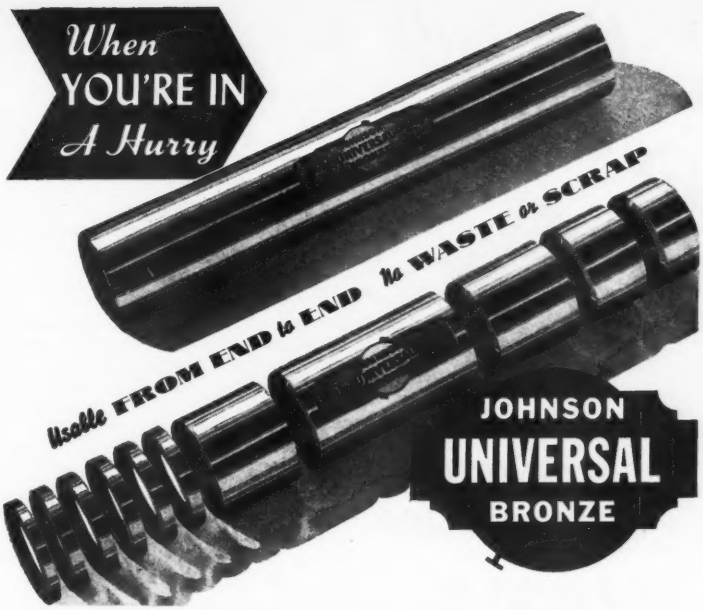
1. The statement is made that the new circuit came direct from the main power plant and that the old circuit came from a sub-station served from the main power plant. We assume that the new circuit is supplied by a generator or by a bank of transformers at the power plant and that the old circuit is supplied by a second bank of transformers at the sub-station. Even though the circuits have been properly phased so that we have the corresponding circuit conductors connected together, there is a possibility that the transformers may not all have the same secondary voltage. It is possible that

in one case the connection has been made to the higher voltage taps. This could result in unbalanced voltages and might mean that not only would one bank of transformers carry more than its share of the load, but that there might actually be some circulating current carried between the two banks of transformers. This might be true of all three phases or it would be possible to have only one phase involved. In some instances there might be an unbalanced voltage component of a higher frequency, that is a harmonic, and this might cause the circulating current. If this condition exists, the line from the higher voltage transformer would probably be carrying more than its normal load and so heating would be caused. This could be remedied by making a careful check of the terminal voltage of each set of transformers under various loads and adjusting voltages to get a balanced condition.

2. The second assumption would be that both lines are fed from the same generator or from the same transformer bank. In this case the question of circulating current would not enter. Since we were advised that one line comes direct from the power plant to the load and the other goes by way of an existing substation, it is possible that the load would not be divided equally. If the new line, which is shorter, has not been designed to take care of the total load of both lines and since it is shorter may take more than its share of the current, it may be overloaded. This condition could be aggravated by possible high-resistance joints or by added resistance in the switching equipment in the substation, or some similar difficulty. If the new line has conductors as large as the old line and the load has not been increased, there is a question as to whether this explanation is complete. If that is the case, it would be well to check carefully for high-resistance joints which might cause local heating.—J.E.W.

A. TO QUESTION 107. If the heating took place at the point of interconnection only, the heating would be caused by one of three conditions: a. Loose connection, b. Local grounding, c. Too small a conductor size on the outgoing or load leads.

2. If the heating took place in either one or the other of the supply lines to the interconnection, improper load distribution is indicated, caused by a considerable difference in length of the service lines or difference in size of same, which resulted in a load division out of proportion to the current carrying capacities of the two sets of conductors, overloading one line at the expense of the other as the loads will divide proportionately to the overall impedances



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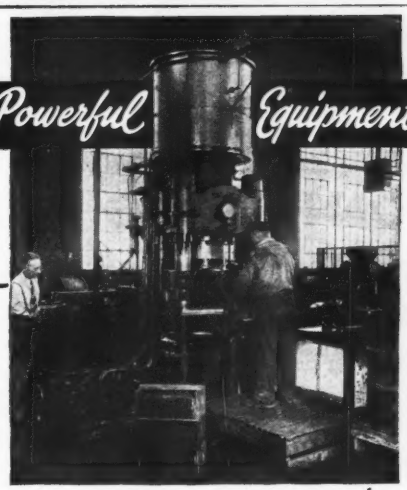

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This 400-ton hydraulic press forms carbon, graphite and metal graphite into plates which are then heated successively in gas and electrographitizing furnaces. The equipment shown here is representative of Superior's adequate facilities. . . The manager of this department, seen at the left, has been with *Superior* for 23 years. He is one of 24 men and women who have given over 10 years apiece to the studied task of making *Superior* Carbon Brushes better.

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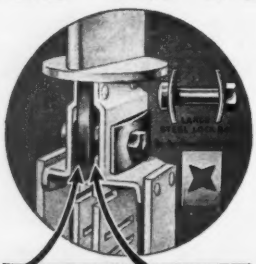
WARE HI-LAG



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Keep Motors Humming

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WARE Renewable HI-LAG FUSES

of the two lines, and the line with the lesser impedance will, of course, carry the higher current, assuming that both lines originate from the same source.

3. If, however, the two lines originated on separate transformer banks, the connection described amounts to placing the two transformer banks in parallel at the point of interconnection and if there is a difference in impedance in the transformers or in the overall secondary systems to the point of interconnection, current will circulate between the transformers independent of the load current, and may reach considerable values if the differences in impedance is appreciable.—C.N.I.

A. TO QUESTION 107. While it might seem at first glance that the voltages and phase relations of the circuits which were to be connected in parallel would be the same after the actual phasing out of the two lines, the probable cause of the heating of the insulation after the connection was made was due to the following reasons: the parameters of the two circuits could not have been equal; this would set a circulating current within the now closed circuit which could well be rather high in value. At the moment of connection the phases may have been proper and the voltages approximately equal. This condition would lead one to believe that it would be proper to connect them in parallel. Such is hardly ever the case, however, and it is almost impossible to connect lines such as you describe without creating a circulating current. This of course could cause considerable heating dependency on current values.—W.B.M.

VOLTAGE DROP

QUESTION 108. We have a 1200 kw., 230 volt M-G set which is more than ample for our direct current needs. My problem is to eliminate a 125 volt, 40 amp. M-G set and use the excess power from my 1200 kw. set to excite a 400 horsepower synchronous motor which uses the above 125 volt, 40 exciter amp. How can this be done?—R.F.M.

A. TO QUESTION 108. In this case where there is available a voltage supply of 230 volt with ample current supply available, a suitable fixed resistor in series with the 230 volt source will provide the necessary voltage drop. If 40 amperes is the measured exciter amperage for the 400 horsepower synchronous motor, a voltage drop of 105 volts can be provided by a 2.625 ohms resistor rated 4.2 kilowatts.—R.K.H.

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Correct size Stove Bolts furnished FREE with each clamp.

All clamps are rust proofed and are designed to hold porcelain bushings, thin wall or rigid conduit, also armored cable.

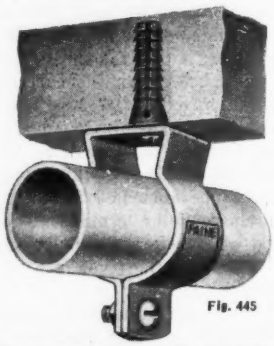

Fig. 445

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WRITE FOR BULLETIN No. 6

TRICO FUSE MFG. CO., Milwaukee, Wis.

In Canada: IRVING SMITH LIMITED, Montreal

A. TO QUESTION 108. Since the 40 amperes required for the synchronous motor field is small in comparison with the output of the 1200 kw. generator, the following method of providing 125 volt supply for the motor field should prove satisfactory:

Install, on the brushholder rocker ring of the generator, an additional brushholder for brushes capable of carrying at least 40 amperes. This additional brushholder should be installed near midpoint on the commutator between adjacent brushes of opposite polarity; i.e. at a point where the required voltage for the synchronous motor field is obtained.

The effect of the added 40 ampere load on the generated and terminal voltages of the large generator will be negligible. However, especial care should be taken to obtain a good mechanical job.—E.S.

A. TO QUESTION 108. The field of the synchronous motor apparently requires 40 amperes at 125 volts and this could be supplied from the 230 volt source if a rheostat or resistance unit having a resistance of almost 3 ohms and a current carrying capacity of 40 amperes is available. This would probably be the simplest method although it would result in the loss of energy at the rate of 5 kilowatts when the motor is in use. The losses in the motor generator set will be saved. The rheostat will develop heat which may be objectionable.—J.E.W.

LOCATING AN OBSTRUCTION IN CONDUIT

QUESTION 109. In a power plant we have run a 4-in. Transite conduit about 100-ft. long in the basement slab, which is 4-ft. thick, and full of reinforcement steel. During the construction period we made a sharp change in direction of this conduit, and as we had no Transite elbows we cut a section of old duct elbow and inserted this in the run. The largest thing we can get through this conduit is a ¼-in. steel fish wire. We know that this conduit lays about 3½-ft. below the surface of the slab, and we assume that this section of duct has collapsed during the under slab grouting process as it was clear and full diameter up to this time. It is imperative that we clear this conduit and we cannot locate this stoppage close enough by measurements. Can anyone suggest a method that we can use in locating this spot so that we might get to it without removing too much concrete?—R.M.

This gives you some idea of the difference in efficiency and RESULTS—when you use the ultra-modern BRIEGEL METHOD of making thin wall conduit connections instead of many old-fashioned methods still on the market.

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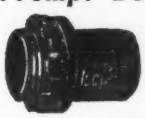

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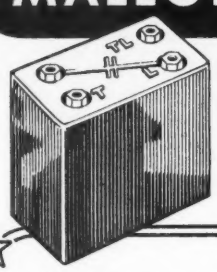

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Get in touch with one of the offices listed here or write for the IWI Blue Catalog.

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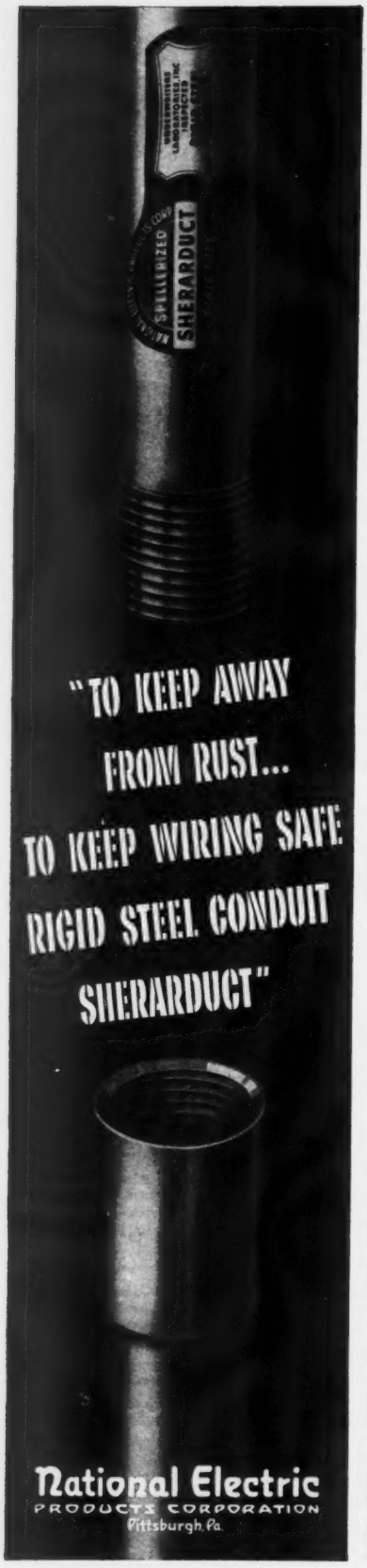

A. TO QUESTION 109. With fish tape pull some object, such as a bolt, through duct until stopped by obstruction. A cord trailing the bolt will give a measurement of the distance from end of duct to obstruction; and this single measurement should suffice if the direction of duct run is accurately known. If not repeat cord measurement from opposite duct end. With duct ends as centers and cords as radii strike arcs, the intersection of which will indicate the location of the obstruction.—N.H.K.

A. TO QUESTION 109. Make a wad, or ball of paper about two inches in diameter, attach at least a hundred foot chalk line, and then blow paper ball into conduit with compressed air.

The paper wad will stop at the obstruction, pull chalk line back and out and measure distance the wad traveled, repeat this procedure from the other conduit opening.

The two measurements on chalk line subtracted from overall length of conduit will tell you the length of collapse, in addition to the exact location, since you helped on the conduit installation.—W.H.L.

Can You ANSWER *these* QUESTIONS?

QUESTION H4—On our motor generator set a bad spot on one collector ring on the a.c. end has recently appeared. This ring is the inner one next to the armature. I'd like to know what caused it and why it is only on one ring. It causes plenty of fire works and I expect it to arc over. These rings get their d.c. for excitation from the d.c. end of same machine.—R.G.S.

QUESTION J4—We have a water gate in a small canal. This gate weighs about ten tons, and slides up and down in a steel structure about thirty feet high. It is powered by a three phase motor through reduction gear with drum and steel cables. The control is pushbutton through contactors with limit switches at upper and lower end of travel. There is no counter balance and the solenoid brake is depended on to hold the gate in the upper position. Once while under operation the brake became locked in the open position. The gate rose and tripped the limit switch disconnecting the motor from the line. The brake not holding allowed the gate to fall, causing the motor to travel at such a high speed it tore the winding to shreds. We have our own idea about this problem, but would like to get some one else's idea as to a remedy.—R.M.

PLEASE SEND IN YOUR ANSWER BY OCTOBER 1

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Pyle-National plug and receptacle equipment is built for heavy duty service, and is being used increasingly on the jobs where dependable service is of first importance. All types have full bakelite insulation, protected contacts and heavy steel or cast metal housings. There is a type and size for use with any portable electrical equipment.

General Purpose plugs and receptacles: 1, 2, 3, 4, 5 poles, ratings 30, 60, 100, 200 amperes. Round prong contacts, rugged cast metal housings to withstand severe service.

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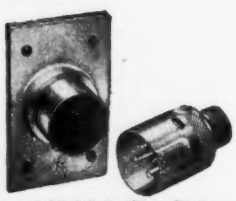
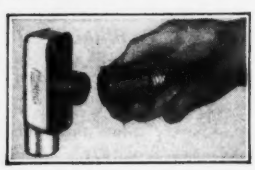


Triploc and Multiple Circuit plugs and receptacles: 1, 2, 3, 4, 6, and 8 pole contact units, allowing assembly in combinations up to 32 poles. Manual and automatic release features. Ideal for portable tools, pyrometers, signal and control circuits.



Midget Triploc, compact, but with many exclusive heavy duty features for dependable service under severe conditions: 2, 3, 4 pole types.

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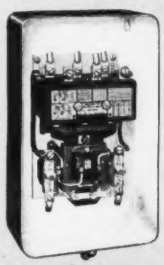

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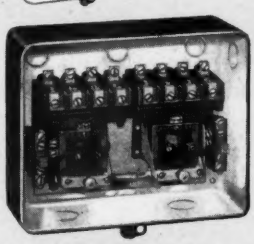
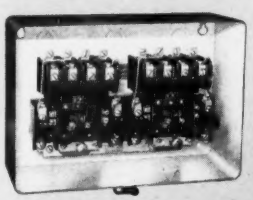


Reversing Switches. Used for across-the-line starting and reversing. They are mechanically interlocked so both contacts cannot be closed at the same time.



Multi-Speed Across-the-line Starters. Provide remote control for two, three, or four speed squirrel-cage motors used on machine tools, compressors, refrigerating, air conditioning, and many other applications.

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Answered by
F. N. M. SQUIRES
Chief Inspector New York Board of Fire Underwriters

QUESTIONS ON THE CODE

Different Frequencies In Same Conduit

Q. *"Article 300—Section 3013—Can you install three conductors for 220 volt 3 phase hi-cycle (180) and two conductors for 110 volt 60 cycle, in the same conduit?"—C.A.H.*

A. Yes, the 1940 Code in Section 3013 permits this.

This section merely requires that all of the conductors occupying the same enclosure be insulated for the highest voltage on any of the conductors contained in the enclosure.

In the case in question the highest voltage is 220 volts and all of our common building wires are insulated for 600 volts, except Types A and A1 insulated wires which are insulated for 300 volts, so the provisions of section 3013 are complied with.

High Voltage Spacings

Q. *"Will you please give me the standard ruling as to the spacing between phases and from phase wire to ground on the following voltages to be applied on outdoor sub-stations:*

2,300
4,000
13,000
23,000
66,000

We use all of the above."—R.M.

A. According to the National Electrical Code, Section 7113, open conductors for voltages over 600 volts shall be kept at least eight inches apart and not less than two inches from the surface wired over, but for voltages exceeding 2500, shall be kept at least three inches from surfaces wired over.

The above is for the purpose of installation where guarding and working space is not required.

Where it is necessary to secure isolation for guarding the spacing above the floor or working space is found in Table 32 of the Code and where working space must be provided for the purpose of making repairs or adjustments to current carrying parts, the spacings are found in Table 33.

These are as follows for the voltages indicated:

Voltage	Vertical clearance for isolation of unguarded parts	Horizontal spacings for working space
2300	8′	3′ 3″
4000	8′	3′ 4″
13000	9′ 3″	3′ 9″
23000	9′ 6″	4′
66000	10′ 5″	4′ 11″

Our Old Friend—Bare Neutral

Q. *"Does the Code permit the use of a bare conductor for the neutral wire of a 3 wire 220/110 volt grounded lighting system within a building run in steel conduit? My interpretation would be "no" as this would introduce multiple grounds upon the system especially so if used in structural steel building. However, I have been told that such installations exist."—W.J.B.*

A. The answer is "No". Permission to use bare (uninsulated) neutral wires is found in only three places in the Code.

Section 2304 permits a bare neutral for services where the voltage to ground does not exceed 208 volts.

Section 3282 permits service entrance cable having a bare neutral conductor to be used for interior wiring for a range circuit or as a feeder from a master service cabinet to supply another building.

Interim Amendment No. 43 permits the use of a non-metallic sheathed cable "having one conductor without individual insulation" for wiring "defense emergency buildings." In reality this latter one is not a bare conductor but has a fibrous covering.

However, some inspection departments have permitted the use of bare neutrals in conduit and cable jobs, but have done so on their own authority. This has not become general.

***WAR DESIGNS,** use and restrictions of busways under present conditions were outlined to inspectors and contractors at the Cincinnati meeting of the Kentucky Chapter, IAEI by Sheldon B. Storer, managing engineer, The Trumbull Electric Mfg. Co., Norwood, Ohio.*

Lead Covering Does Not Cause Induction

Q. *"Does Section 3052 of Article 300 pertain to lead covered cables? If so would this not limit the use of single conductor lead covered cables to direct current only?"—W.J.B.*

A. The lead covering of insulated conductors is not considered as a "raceway", "cable armor" or "metal enclosure" within the meaning of the first sentence of Section 3052. It is merely a water proofing sheath put over the insulation to keep out moisture or water in order that the conductors may be used in wet locations. It is also sometimes used as protection for the rubber insulation against deleterious substances such as oil, gasoline, etc. The lead sheath may be applied over a single in-

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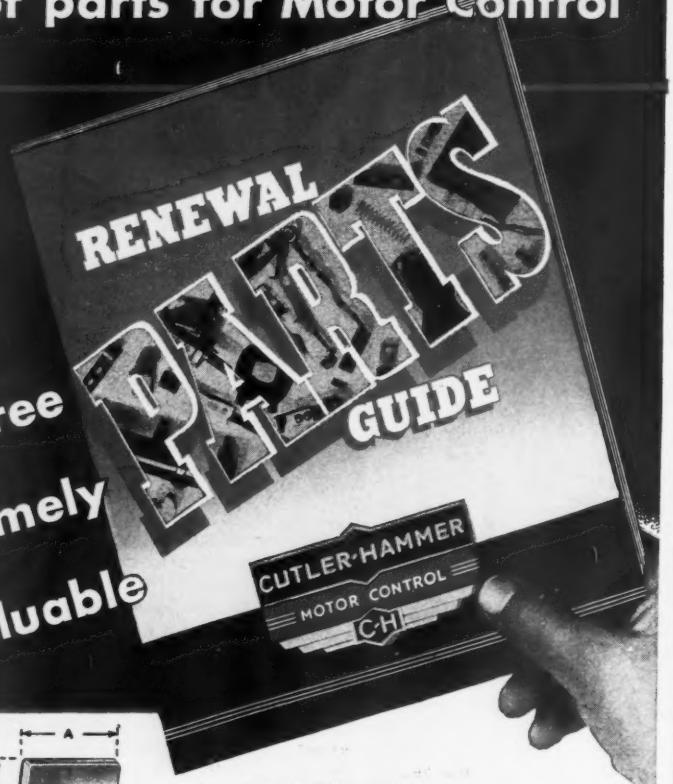

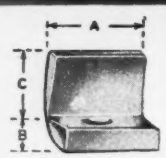

A	B	C	Part No.
½ in.	⅞ in.	⅞ in.	1321-1624
¾ in.	⅞ in.	⅞ in.	1321-1647
1 in.	⅞ in.	⅞ in.	1321-1617

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sulated conductor or over an assembly of two or more insulated conductors.

Also the lead sheath does not have to be considered as violating Section 3052 because the lead sheath being non-magnetic, does not become overheated by induction. For the same reason, nonferrous or non-magnetic conduits or enclosures made of metal such as brass, would not conflict with this section as they are not subject to induction.

However, on a.c. circuits, all wires, whether lead covered or not, and whether lead covered singly or in assemblies, must be kept within the same conduit or enclosure to prevent induction as the lead covering does not prevent the induction taking place in any magnetic outer enclosure if the conductors are not arranged according to the first fine print note under Section 3052.

Color Coding For Switch Legs

Q. *"Here is a question that has caused a good deal of argument for quite sometime. In conduit wiring what color wire should be used for three-way switch dummies? We cannot find the answer in the Code. Some claim white, some black and some contend any color other than white."—L.R.D.*

A. The wires between three-way switch outlets should be, one white for the unswitched neutral and two of some other color or colors.

Section 2006 prohibits the use of a white or neutral-gray wire for any except the identified conductor (the neutral) unless that color is rendered permanently unidentified by painting or otherwise, except that with cable work the identified (white neutral) wire may be used for switch legs if proper connections are made so that the unidentified conductor is the return from the switch to the outlet as provided in 2006 b.

Of course where conduit or raceways or open wiring is used, there is no excuse for using a white wire on the switch legs and all black wires can be used except between outlets where the neutral is carried in which case the neutral wire should be white.

If the grounded wires of a particular circuit are not black in accordance with the rules of color-coding in section 2104, the switch wires should be of the same color as those circuit wires (and both of the same color).

In order to obtain a fuller understanding of the requirements as indicated above, I suggest a close examination of sections 2006 and 2104.

V
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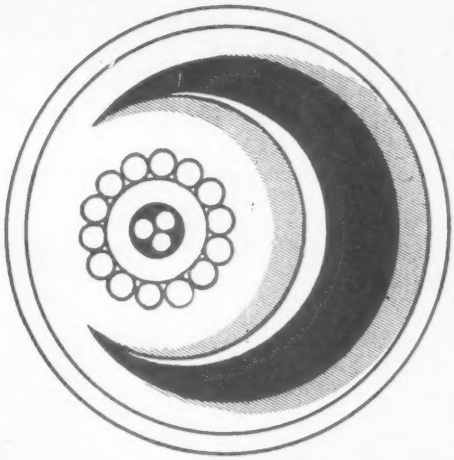

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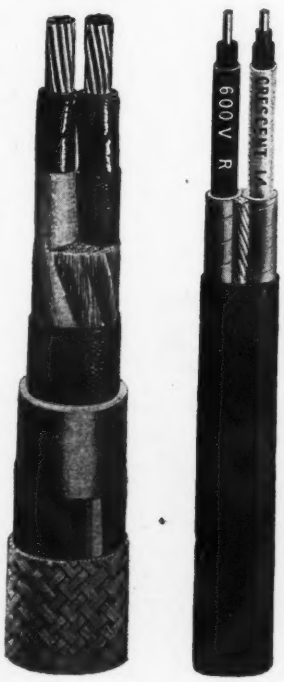

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MOTOR SHOPS

INFRA-RED SPEEDS COIL BAKING

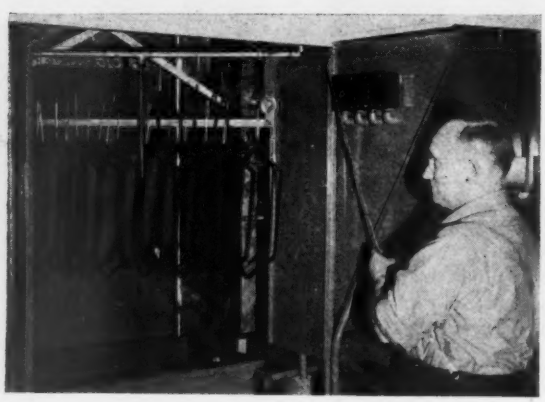
The use of infra-red lamps is still looked upon by many as an expedient measure in the event of an emergency, but many more are turning to its use in normal production procedures. It is rapidly replacing the gas and electric baking ovens that motor shops have relied upon for years to bake coils, motor and transformer windings. Infra-red ovens in some instances have reduced the baking period to one-sixth the time required by ordinary ovens.

The H. N. Crowder, Jr. Co., contractor and motor repair shop of Allentown, Pa., has recently completed construction on a new infra-red oven for coil baking. C. R. Durand, service shop superintendent, along with several of his men have been experimenting with infra-red heating for the past two years and the final outcome of their research is this new oven of their own design. They found that ordinary rectangular loops being four inches from the lamps would heat up to about 200 deg. C. in 15 minutes, at which time they would be dipped in baking varnish. After dipping, an average of one-and-three-quarter hours in the lamp oven would give the coil an excellent baking. In addition they did quite a bit of experimenting with various grades of varnish suitable to this type of baking until the varnish was found which gave the most satisfactory results.

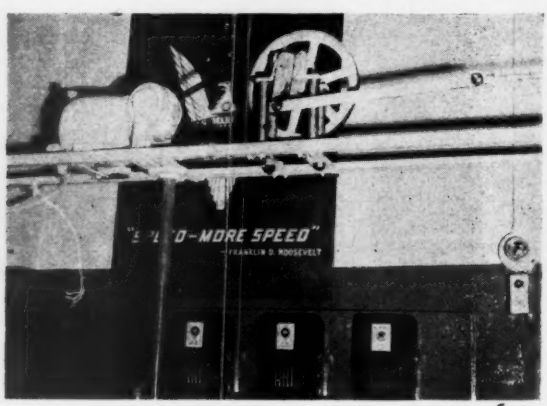
***WAR PRODUCTION** in a motor repair shop. More than 90 percent of the machine shop capacity at Jack Pilmer's Electrical Engineering and Construction Co., Des Moines, Ia., is devoted to war subcontract work. This lathe operator is machining tough steel pins for the Link-Belt Ordnance Company.*

At the time when they were contemplating the construction of a new oven, it was decided to move all the coil winding equipment from the main shop and into a separate unit which would accommodate both the winding equipment and the new oven. It was thought (and later proven correct) that in this manner they could quite economically carry on their normal work at such an accelerated pace that sufficient time would be gained to do the emergency repair work which is increasing rapidly.

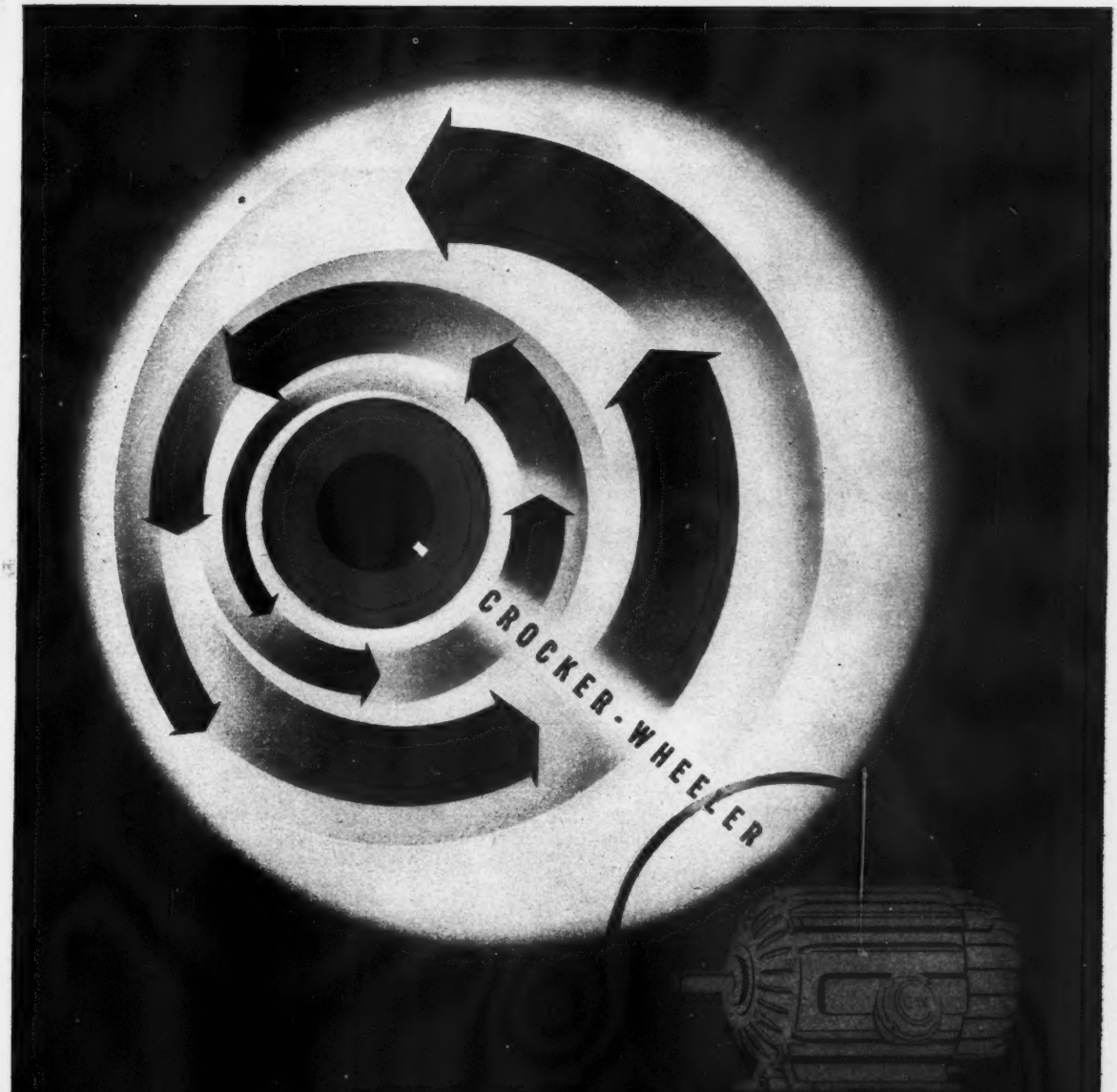
A sliding track is run the entire length of the oven and is suspended on grooved supports. One end is free and the other end of the sliding track is attached to a crankshaft that is geared to a small motor. By this means the sliding track oscillates slowly back and forth. Trolleys, which have a capacity for 12 coils, are mounted on wheels that ride the sliding track and allow the trolley to run from one end of the oven to the other; they can, how-



***TROLLEY** with 12 coils has just been moved from the preheat area on the left, and after dipping and draining will move into the baking area at the right.*



***THIS UNIT**, composed of motor, gear box and crankshaft, is used to oscillate the trolley track back and forth, so that baking coils get an even and thorough bake without danger of hot spots.*



20,000,000 hp

OVER 20,000,000 horse-power bearing the Crocker-Wheeler name is serving the war effort, on land and sea.

Many of these motors and generators were built a generation ago . . . some were made in 1943. But all of them were built to stand up under unusual conditions.

Watching over them is a corps of carefully trained field engineers, to whom the difficult and the unusual are all in a day's work.

We can make immediate deliveries on some types . . . consult your nearest Crocker-Wheeler office, or wire us.

Crocker-Wheeler Electric Manufacturing Co., Ampere, N. J.
Division of JOSHUA HENDY IRON WORKS

Be SURE . . . with
CROCKER-WHEELER

Other JOSHUA HENDY IRON WORKS factories at Sunnydale, Pomona and Torrance, Calif. and St. Louis, Mo.

UMI

. . . "a bridge of ships

"See-ability"... helps put ships together in record time . . .

America's 1943 output of ocean-going freighters is set at 19,000,000 tons . . . more than double 1942 production.

To attain this goal, scores of supporting industries must continue to contribute their highest skills.

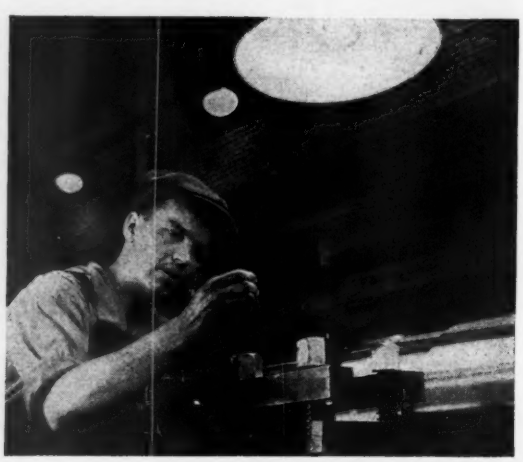
For example, the lighting industry! In shipyards everywhere—in the drafting rooms, the mold lofts, machine shops, and on the ships themselves—"See-ability" is helping men work more accurately and effectively.

Helping men build ships is one of the jobs for which millions of brighter, long-lasting Westinghouse Mazda Lamps are earmarked.

Help war factories get more light

Many of our war factories are so busy producing supplies for our armed forces, that their lighting systems get no attention. "See-ability" for workers is thereby reduced. You can help these factories get more light. Suggestions are given in a booklet "See-ability for Indoor Eyes". A free copy is yours for the asking. Westinghouse Electric and Mfg. Co., Lamp Division, Bloomfield, N. J.

KEEP YOUR DOLLARS FIGHTING . . . BUY WAR BONDS



to span the oceans"

UMI

Fluorescent and Incandescent

A GOOD THING *to* LOOK *for on* YOUR LAMPS

The *diamond* symbol appears on every genuine CHAMPION lamp. Its four points signify:

1. **CHAMPION QUALITY** — guaranteed to equal or exceed Federal Specifications; backed by a big, modern plant containing complete production, testing and engineering facilities and by an organization specializing in fine lamp manufacture since 1900.
2. **CHAMPION SERVICE** — the right *Fluorescent* or Incandescent Lamps for each specific need. Trained experts in the field, prepared to render competent assistance on any lamp or lighting problem.
3. **CHAMPION ECONOMY** — lower light and lamp costs than are obtainable with any other lamps of equal quality.
4. **CHAMPION DISTRIBUTION** — through qualified industrial suppliers in your locality, equipped to meet emergency needs efficiently and economically.

Look for the CHAMPION Diamond. Remember what it stands for.

CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.

ever, be locked into position during baking so that they oscillate with the track. The oscillation of the coils back and forth before the lamps prevents the possibility of hot spots which might injure insulation. A good even thorough bake has been the result.

As the winder completes a group of 12 coils they are hung onto the trolley and moved into the preheating area where the coils are brought up to the correct temperature for dipping in about 15 minutes. The trolley is then moved further along the track into the dipping area where, after dipping, they hang over the tank for a sufficient draining period. They are then moved on into the baking area where baking is completed in an hour-and-a-half to two hours. In the meantime other coils follow the first group down the sliding track and into the final baking area which will accommodate two racks of 12 coils each.

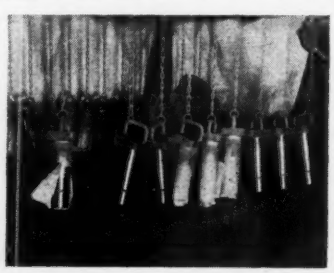
Three groups of 28 lamps each constitute the baking area. The lamps are placed on seven-inch centers each way and are adjustable so that they may be moved into or away from the coils. One snap switch controls four 250-watt Westinghouse lamps, and each group of 28 lamps are provided with a circuit breaker.

Durand claims that results achieved to date are more than satisfactory, and with their present space limitations could not possibly turn out the quantity and quality work which is now being accomplished, without the use of the infra-red ovens.

ELECTRIC BURN OUT OVEN

Motor stators are burned out in an electric oven before they are placed on the coil pulling rack at the motor service shop of the Wm. C. Krauth Electric Company, Louisville, Ky.

The oven, which is adjacent to the stripping rack, consists of a 38-inch square galvanized sheet enclosure, 24½-



***READY FOR ACTION**—These gun mount accessories made by Electrical Engineering & Construction Co., Des Moines motor shop, under sub-contract to Link-Belt Ordnance Co., dry after being sprayed. Protective skirts on some have already been removed.*

First of All

COME TAPE'S WAR JOBS

Maybe you don't hear much about tape as a valuable aid to the war effort. But it's like the PT Boats that flash in close to the enemy... zoom a torpedo to the target ...and are off again in record time.

Tape doesn't make the headlines often ... yet it's an integral part of the war effort. It's used in every branch of the war effort. It's used in every branch of the Armed Forces... in every industry that supplies the Armed Forces.

Naturally, these needs come first. Other orders are being filled as rapidly as possible.

UNITED STATES RUBBER COMPANY

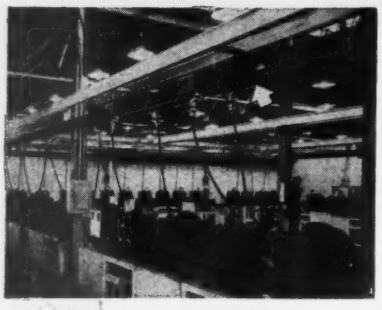
1230 Sixth Avenue • Rockefeller Center • New York

Listen to the Philharmonic Symphony program over the CBS network, Sunday afternoon 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

SECURITY ON ALL FRONTS

UMI

7 PLUSES IN NEW LO-X *Ventilated* FEEDER DUCT

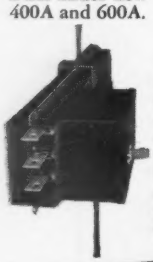


Flexible Light and Power

Built in standard, interchangeable 10-foot sections, BullDog BUStribution DUCT provides *complete flexibility* on branch power and lighting circuits. The plug-in feature enables you to change production machines at will—rearrange whole departments without interrupting production elsewhere.

BUStribution DUCT is quickly and easily installed—makes sensational savings in maintenance.

Capacities available for Plug-in Type Duct under new WPB standards are 250A, 400A and 600A.



PLUG-IN TYPE for Branch Circuits

(Left) End view of branch circuit plug mounted on a bus duct section—showing how copper "contact fingers" clamp over the busbars in the duct. Plugs are readily interchangeable. Capacities: 30A to 600A; 600 Volts or less.

+ **Increased current-carrying capacity**
+ **Lower operating temperatures**
+ **Lessened voltage drop**
+ **Lighter weight**
+ **Maximum saving in critical materials**
+ **Improved appearance**
+ **Easier maintenance and inspection**

CONFORMS TO WPB LIMITATION ORDER L-273

Ventilated type LO-X Duct for Feeder runs also shares all the basic advantages of BullDog's famous BUStribution DUCT design. It is quickly and easily installed—has full asset value—is 100% salvable. Available in the new WPB ratings of 800A, 1000A, 1350A, 1600A and 2000A. Single-phase, 3-phase, and 3-phase 4-wire; 600 Volts or less.

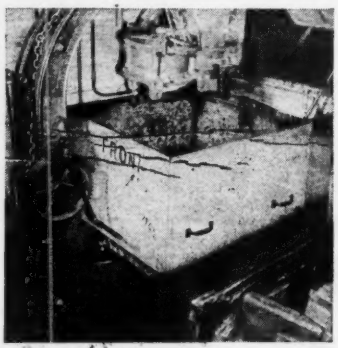
BULLDOG
ELECTRIC PRODUCTS CO.
DETROIT, MICHIGAN
BullDog Electric Products of Canada, Ltd.
Toronto, Ontario
Branch Offices in Principal Cities

MANUFACTURERS OF a complete line of Vacu-Break Safety Switches, Panelboards, Switchboards, Circuit Master Breakers and BUStribution SYSTEMS.

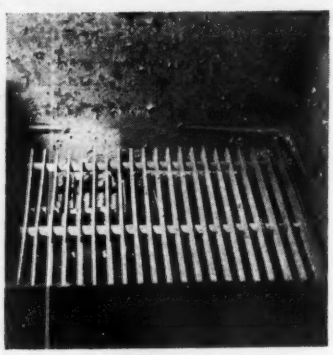
To help win the war, SAVE metals—SAVE fats—SAVE money, BY BUYING WAR BONDS

inches high. All four sides, top and bottom are well insulated by a 1-inch layer of asbestos insulation containing an integral air duct and installed between the inside and outside sheet steel sides of the oven.

Loading and unloading flexibility is provided by resting the enclosure 9-inches above floor level on four supports. This feature permits floor cranes to slip under the oven when placing a



ELECTRIC HOT BOX burns out motor stators so they can be easily stripped of their old copper in this Louisville motor repair shop. Strip heaters do the job. Note removable side for large motors.



STEEL GRATE over electric heaters supports the motors and equipment to be burned out.

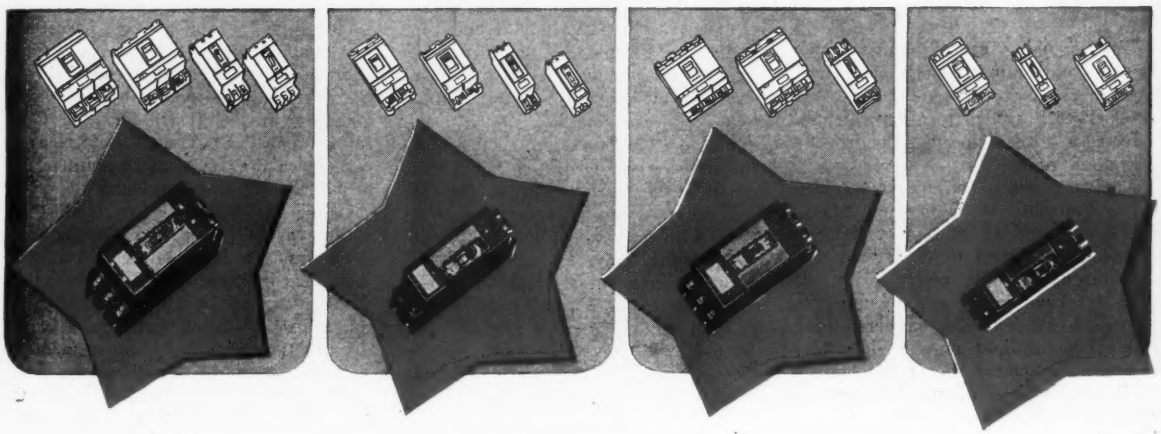
motor therein. A removable side, equipped with handles, facilitates loading equipment that is too large for the shop cranes to handle.

Electric heat is provided by nine 500-watt strip heaters, three in series per leg, connected in delta on a 230-volt three-phase circuit. Single heat is used at this time but provisions can be made for multiple heat operation and automatic control either by thermostats or time clocks. Under present operations, the average time for burning out a 10 hp., 1800 r.p.m. stator is approximately 2½ hours.

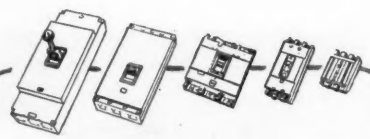
A steel grating mounted above the heaters supports the motors. Before the oven is loaded, a metal cover is placed over the grating to catch any insulation, paint or varnish that might drip off the heated frame.

mobilized FOR WAR

4 breakers
TAKE THE PLACE OF 14



——TO SAVE 18% COPPER
——TO SAVE 38% STEEL
——TO CONSERVE SPACE
——TO IMPROVE CIRCUIT PROTECTION



Nofuze "De-ion" Breakers

—prevent *harmless* overloads from interrupting war production.

—protect circuits from *dangerous* overloads and "shorts."

—restore service *instantly* with just a flip of the switch.

As a voluntary war measure, Westinghouse has "mobilized" the Nofuze line of "De-ion" Breakers. For example, all ratings from 15 to 100 amperes have been made available in one compact frame size. Instead of 14 models, 4 now serve the same purpose. Pole spacing and terminal arrangements have been made standard for interchangeability. Space is saved—vital materials are conserved.

Today, the production of Nofuze Breakers is concentrated on war requirements. Our engineering facilities are serving all branches of the war effort on a broad consulting basis.

Result: many far-reaching developments are being made . . . overload protection of low-voltage circuits has been greatly improved. If you have a war circuit problem, ask your Westinghouse representative for engineering help. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-60523

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

NOFUZE CIRCUIT PROTECTION

UMI

MODERN LIGHTING

BLACKOUT CONTROL

When bombing seemed imminent some months ago, almost every industrial plant in the country provided some sort of emergency system to allow essential movement through the plant with some degree of safety.

The first step taken by Heald Machine Company of Worcester, Mass., was to provide an emergency lighting system. On centers of 60 feet by 120 feet throughout the entire plant, 25 watt blackout lamps are mounted to provide a shade under one-tenth of a foot-candle of light on the aisle floor below. The power for this blackout lighting system is supplied by emergency circuits which also serve the hospital and the communications system.

An automatic starting gasoline driven generator supplies current over emergency circuits in case of failure of the two power sources. One primary consists of two 13,200 volt feeders used alternately in periods of two months. A standby of 3500 volts takes over for emergencies to feed certain power and light requirements. A magnetic switch automatically throws over to the standby feeder in the event of the primary failing. Only in the event of failure of both primary and standby feeders will a second magnetic switch throw onto the gasoline driven generator which in four or five seconds will be up to capacity and voltage—20 kw., 115–208 volts.

The first blackout signal is communicated to plant employees over the program bell system. At this signal all operators shut down their machines and stand by. Then all a.c power is cut off at the main substation with the exception of the feeder carrying the a.c. motor—d.c. generator sets. After a sufficient predetermined lapse of time, this circuit is disconnected. The purpose of the delay is to make sure that all rotating machinery utilizing magnetic chucks has been given sufficient time to stop. If the d.c. were cut off while a piece of metal was revolving on a magnetic chuck, the flying missile could do nearly as much damage as a blockbuster.

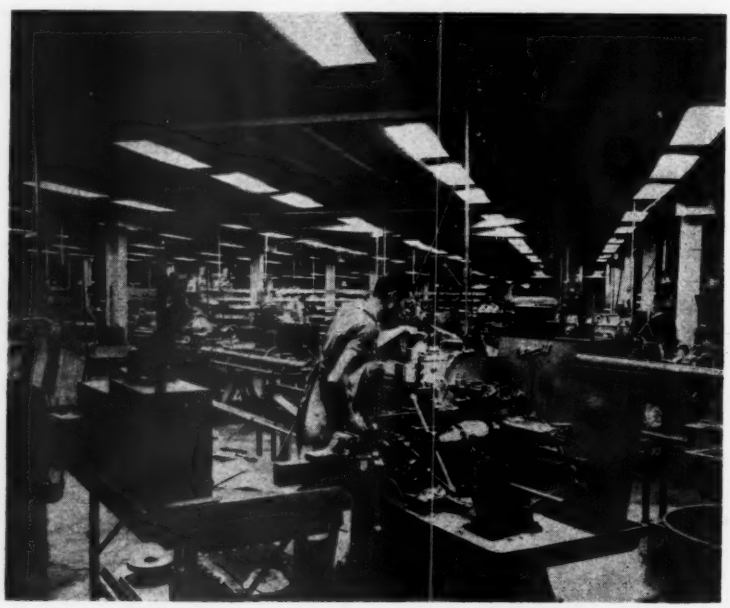
Last to be disconnected are the main lighting breakers. As these are thrown, the emergency circuits are automatically tripped "on" instantaneously. That is, normal and emergency circuits are so interlocked and arranged that the hospital and communications are never without power; and as the normal lights are disconnected, the blackout lights come on immediately. The control of the whole operation comes from one spot—the main substation. No running around from point to point is required with the entailed delays of checking, phoning, etc.

The preparations at Heald have been well designed by Plant Engineer Carl L. Knutson; however, it is hoped that its use will never become actually necessary.

LIGHTING FOR ENGINE LATHE OPERATIONS

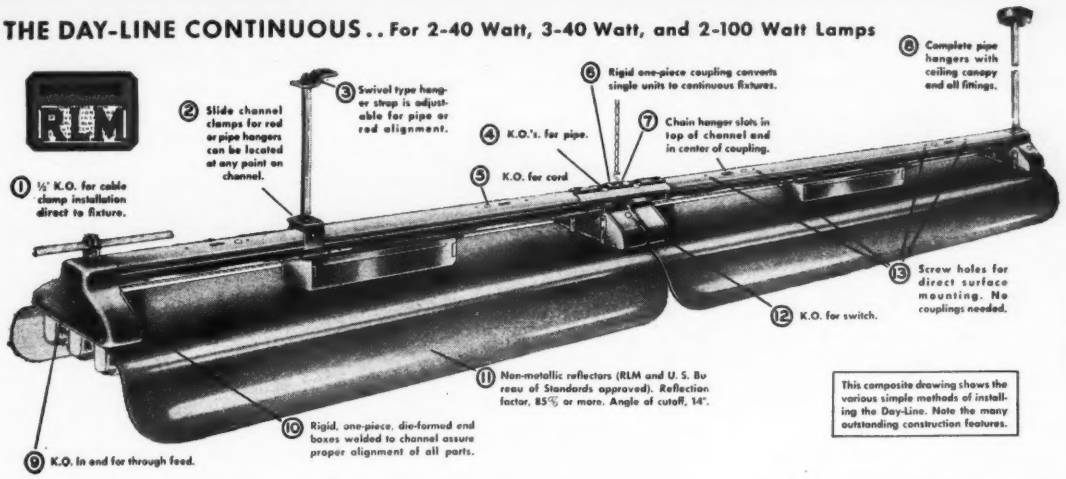
This is the first of a series of short articles on modern lighting practice for various tasks performed in typical war plants. The data incorporated in these items are derived from a compilation of modern lighting practice and recommendations presented to industrial representatives attending a series of Wartime Lighting Conferences held in Chicago and sponsored by the local War Production Board and the Chicago Lighting Institute. Before each conference was held, a committee of prominent lighting engineers made a survey of representative industrial plants carefully studying the lighting system and the illumination problems of individual machine operations. With this data on actual lighting conditions as found in the plants visited as a background, they compiled their recommendations based on good engineering practice and brought to their audiences the comparative effects of both conditions on efficient production.

When recommending adequate and proper lighting for motorized lathe operation—the most common and typical of the horizontal spindle machine group—the following seeing tasks must be carefully considered:



"V" LIGHTING—for vision, visibility and victory at the Vultee Aircraft Co., California. Better than 50 foot-candles of cool, even illumination in this small parts department facilitate maximum production. A total of 92 Benjamin RLM type 3-lamp fluorescent units, each with three 36-inch daylight lamps, are used for general lighting. Supplementary machine lighting consists of individual flexible arm incandescent units.

THE DAY-LINE CONTINUOUS.. For 2-40 Watt, 3-40 Watt, and 2-100 Watt Lamps

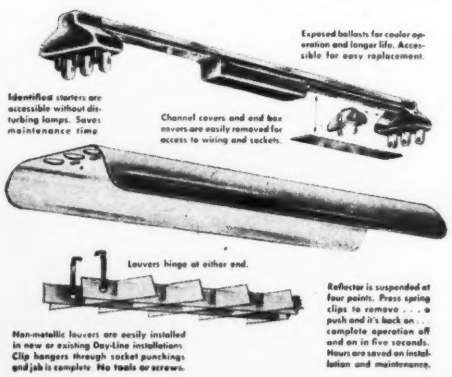

RLM
1 ½" K.O. for cable clamp installation direct to fixture.
2 Slide channel clamps for rod or pipe hangers can be located at any point on channel.
3 Swivel type hanger strap is adjustable for pipe or rod alignment.
4 K.O.'s. for pipe.
5 K.O. for cord
6 Rigid one-piece coupling converts single units to continuous fixtures.
7 Chain hanger slots in top of channel and in center of coupling.
8 Complete pipe hangers with ceiling canopy and all fittings.
9 K.O. in end for through feed.
10 Rigid, one-piece, die-formed end boxes welded to channel assure proper alignment of all parts.
11 Non-metallic reflectors (RLM and U. S. Bureau of Standards approved). Reflection factor, 85% or more. Angle of cutoff, 14°.
12 K.O. for switch.
13 Screw holes for direct surface mounting. No couplings needed.

This composite drawing shows the various simple methods of installing the Day-Line. Note the many outstanding construction features.

Quickly Installed—Continuous or Unit Mounting

THE DAY-LINE UNIT..

For 2-40 Watt, 3-40 Watt, and 2-100 Watt Lamps


Exposed ballasts for cooler operation and longer life. Accessible for easy replacement.
Identified starters are accessible without disturbing lamps. Saves maintenance time
Channel covers and end box covers are easily removed for access to wiring and sockets.
Louvers hinge at either end.
Reflector is suspended at four points. Press spring clips to remove . . . a push and it's back on . . . complete operation off and on in five seconds. Hours are saved on installation and maintenance.
Non-metallic louvers are easily installed in new or existing Day-Line installations. Clip hangers through socket punchings and job is complete. No tools or screws.

Here, in one fixture, are combined all the lessons in lighting learned on the production fronts of war . . . An outstanding feature of these new models is the structural rigidity of the one-piece end stamping welded to the backbone of the fixture. High reflection values and long life are assured by Day-Brite's "Super-White" baked enamel finish on non-metallic reflectors. Quickly installed—flexible surface or suspension mountings. All components and accessories designed for easy accessibility . . . Get Bulletin F-69—call your Day-Brite engineering representative. 70

DAY-BRITE LIGHTING, INCORPORATED
5435 Bulwer Ave. • Saint Louis, Missouri

DAY BRITE
The Sign of Quality
Look for this Label

Day Brite
LIGHTING FIXTURES

COMMERCIAL • INDUSTRIAL and SPECIAL DESIGNS *Nationally distributed through all leading electrical supply houses*

UMI

A few of the many G-E fittings available

High Quality
ELECTRICAL FITTINGS
For Wartime Wiring

All of the electrical fittings needed on wartime wiring jobs can be found in the high quality General Electric line.* There are over 450 different items available—all of them particularly suited for today's needs.

For instance, there are fittings for BraidX, the non-metallic sheathed cable being used in factories and in war housing; there are connectors for factory bus drop cable; there are fittings for use with service entrance cable; and there are fittings for basket weave shielded cables and other cables. There are fittings for all raceways such as rigid conduit, thin-wall conduit, etc.

For further information, see the nearest G-E Merchandise Distributor or write to Section C931-8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

*In keeping with WPB cadmium limitations; G-E fittings have bonderized non-metallic finish

GENERAL ELECTRIC

The lathe operator must be able to:

1. Easily see the cut being made *at the tool point* without being hampered by blinding or sharp contrasts of brightness from shadows.
2. Easily read verniers of cross feed and compound feed dials.
3. Easily read circumference scales of compound feed.
4. Easily read centering gauge or indicator.
5. Read pitch table on side of machine, giving settings for thread cuts.
6. Follow boring and facing operations.
7. Easily read machinists' instruments.

From the above it is apparent that the lighting must be engineered to the seeing problems of the machine operator. Prime among these is visibility for reading scales and dials—best obtained when the background is uniformly bright. The surface then acts as a mirror, imaging the light source to provide the brightness contrast which the operator needs to clearly see the scale or dial graduations.

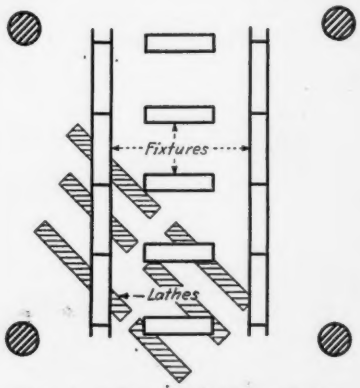


FIG. 1—GRID LAYOUT or ladder system of fluorescent fixtures may be the most practical to install. Lathes should be located at approximately 45 degrees to the lighting units.

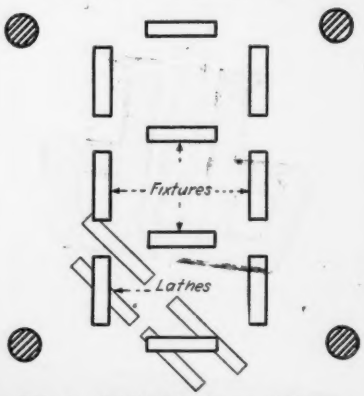


FIG. 2—OPEN BOX layout of fixtures may prove to be the most practical with units using two 100-watt lamps. Here, also, lathes should be placed at approximately 45 degrees to the fixtures.

UMI

EXTRA PROTECTION OUTSIDE

The cast iron frame and end shields are so constructed that the internal working parts of the motor are fully protected from falling dirt or dripping liquids.

EXTRA PROTECTION INSIDE

Windings are protected from unusual moisture or dirt conditions by special "baked in" insulation treatment which greatly increases the life of the motor.

MASTER ELECTRIC MOTORS

1/10 TO 100 HORSEPOWER

THE MASTER ELECTRIC COMPANY • DAYTON, OHIO

EXTRA RUGGED CONSTRUCTION

Unusually heavy alloy steel shafts and oversize bearings add greatly to the durability of Master Motors. In Squirrel Cage motors the rotor windings are cast integral with the rotor laminations.

EXTRA FREEDOM FROM VIBRATION

The rotor of every Master Motor is dynamically balanced to eliminate noise and destructive wear due to vibration from an out-of-balance condition.

Immediately Available!

SAVE CRITICAL MATERIALS

Government restrictions on the use of critical materials for electrical connections do not affect IDEAL "Wire-Nuts" — because these solderless,— tapeless connectors do not require lead, tin and rubber. Thousands of contractors making millions of wire joints have already standardized on "Wire-Nuts".

BETTER, Electrically; STRONGER, Mechanically!

IDEAL "Wire-Nuts" speed wiring, make BETTER wire joints — FASTER! The coil spring insert automatically compresses, twists and "threads" the wires and the "Wire-Nuts" together to make a joint several times stronger than soldered joints. FULLY APPROVED. Listed by Underwriters' Laboratories, Inc.

Sizes for Every Job, from small conduit fittings to sizes large enough to join 3 No. 10 wires. Ask your Electrical Jobber for Samples.

PROMPT SHIPMENT

IDEAL Wire Nuts

Solderless, Tapeless Wire Connectors

IDEAL Sycamore

★ IDEAL COMMUTATOR DRESSER CO ★

1041 Park Ave., Sycamore, Ill. Sales Offices in All Principal Cities

For such a seeing task the light source should be large enough to provide a reflected image band that includes at least one complete set of divisions on the circular scale and should cover the entire surface of flat scales. Small light sources, such as bare lamps, give a spotty effect and tend to increase brightness in critical areas of the dial to a point where no contrast is visible.

Lighting for *boring and facing* operations must have a *high vertical* component. In boring, the operator must watch closely the cut and the tool. For deep bores, the boring bar usually hampers close watch of the tool, but the surface has to be inspected after the bar and tool have been removed. In facing operations, the cut must be closely watched, for chatter may develop and spoil the stock. For systems where the general lighting installation does not provide sufficient vertical intensity, local lighting units may be necessary to supplement the general illumination—providing the necessary vertical light.

Lighting Recommendations—That the solution of most of the problems outlined above lies in a properly engineered general lighting system, was borne out by the lighting engineers' survey. Fluorescent lighting, when properly applied, has the advantage of being a large area light source and is particularly applicable to lighting for engine lathe operation.

The committee's recommendations suggest the use of two and three-lamp fluorescent reflectors which are available. For mounting heights from 8 to 14 feet, units with 40-watt lamps should be installed; over 14 feet, 100-watt lamps. To obtain the best results, lathe beds should be placed at 45 degrees with the axis of the fixture. Such an arrangement produces the most effective reflected image in all micrometer collars. The ideal solution is to have the lighting fixtures mounted at right angles to themselves, but at 45 degrees with respect to the lathe bed as shown in Figures 1 and 2. This reduces the streaky effects on the stock and on the dials of the machine.

When a fluorescent fixture is parallel to the axis of the graduated dial, the band, or reflected image, will be proportional to the width of the fixture—which is not enough. Since the compound feed and other dials will not always have their axis in the same direction, the reflected image from 45 degree mounting in two directions will be proportional to a light source with a length ranging between that equivalent to the length of the fixture divided by 2 (approx. 1.41) and the length of the fixture. This means a variation in position of the dial from 45 degrees to the fixture, to parallel to the axis of the fixture.

Here are the NEW

certified FLEUR-O-LIERS

...with more to come

GRUBER
ENDER
SUN-LITE
CURTIS
WAKEFIELD
LEADER
TRU-AD
LIGHT CONTROL
WILEY
A. L. SMITH
ELECTRO
WILLIAMS
MITCHELL
EASTERN
Certified
FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the "SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS" which are sponsored by the Manufacturers of Mazda Lamps.
Electrical Testing Laboratories, Inc.
NEW YORK, N. Y.
E.T.L.
A COPY OF THIS CERTIFICATE SHOULD APPEAR UPON EACH UNIT OR PACKAGE
FLUORESCENT LIGHTING FIXTURES EMPLOYING EXISTING TYPES OF LAMPS ARE NOT RECOMMENDED FOR SCHOOLS, OFFICES AND SIMILAR LOCATIONS UNLESS LAMPS ARE SHIELDED FROM DIRECT VIEW
THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 85% POWER FACTOR
When you specify fluorescent lighting fixtures, get the protection this label gives.

Shown here are some of the TESTED, CERTIFIED, GUARANTEED FLEUR-O-LIERS. Models of other FLEUR-O-LIER Manufacturers are now in the testing laboratories and will be released shortly.

Many sources of supply... and extra protection for YOU!

The big idea back of FLEUR-O-LIER is protection *for you.* It's a practical, helpful program that has already served scores of war plants. Many leading fluorescent fixture makers participate.

The Fleur-O-Lier *label* on a unit tells you at a glance that this product was *Tested* by impartial, independent Electrical Testing Laboratories, Inc., New York; *Certified* by them as meeting 50 definite standards set up by Mazda lamp manufacturers; and checked again at the factory four times a year by E. T. L.

Fleur-O-Lier standards cover all important features for good lighting *performance* and *service* as well as WPB and Bureau of Standards requirements. And you get many PLUS features provided by individual makers.

Wherever you're located, there's a Fleur-O-Lier Manufacturer not far away. Leading jobbers sell Fleur-O-Liers. You can get Fleur-O-Liers on suitable WPB priorities.

NEW! Write now for booklet containing complete FLEUR-O-LIER engineering specifications Reprinted to include information on lightweight channels. You'll want this book when you specify fluorescent installations. With it you get the FLEUR-O-LIER story and list of manufacturers. Address FLEUR-O-LIER MANUFACTURERS, 2122-9 Keith Bldg., Cleveland 15, Ohio.

FLEUR-O-LIER

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

UMI

Simplified

CAPACITOR REPLACEMENT

● Yes, it's simple and profitable to service electric refrigerator motors when you use Aerovox replacement capacitors. No guesswork. No delays. No complaints nor return calls to make good on jobs. Here's why it's simplified, the Aerovox way . . .

1. Look at motor nameplate. Then look for corresponding type designation in Aerovox catalog listing. You now have the correct replacement information.
2. There's usually a choice of either the exact-duplicate replacement or a universal type. Either works satisfactorily.
3. Best of all, your Aerovox jobber carries a stock of motor-starting capacitors to meet your needs promptly.

● Ask your jobber for latest catalog. Order your capacitors from him. Or write us direct for further information.

AEROVOX *Capacitors*

INDIVIDUALLY TESTED

AEROVOX CORP., NEW BEDFORD, MASS., U. S. A.
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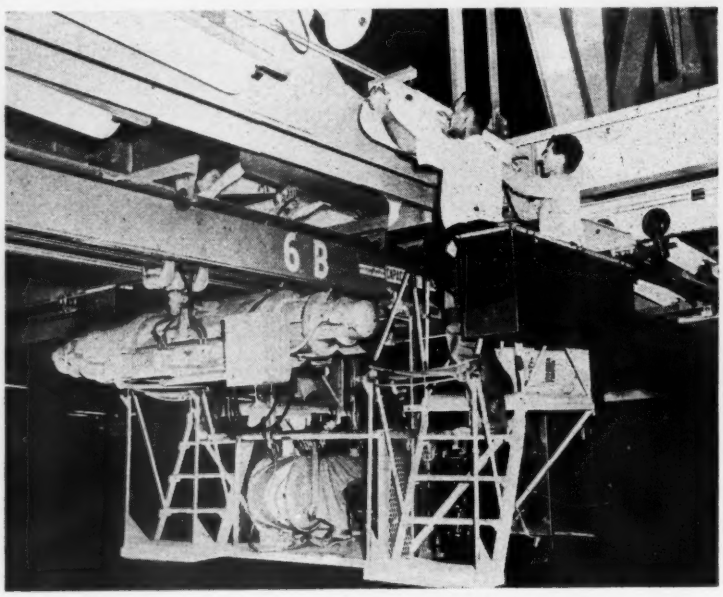
ENGINEERED FLUORESCENT MAINTENANCE

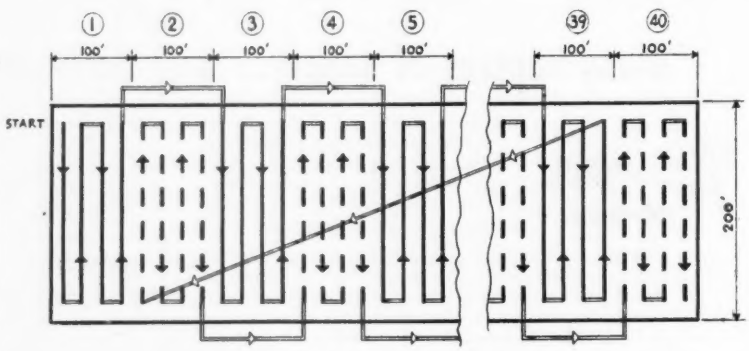
One of the first problems confronting the maintenance department of Consolidated Aircraft Company's giant Texan plant, recently built by The Austin Company, was that of organizing a plan to maintain more than 20,000 rectified fluorescent fixtures and some 5000 other fluorescent units throughout the plant area. A majority of these RF units are mounted 40 feet above floor level in a long assembly bay, 200-ft. wide.

To maintain so vast a lighting system, in service round the clock seven days per week, is an engineering task in itself. Approaching it from this angle, the maintenance engineers devised a method that incorporates a thoroughness and long-range viewpoint that will benefit all who study the scheme.

The first problem was to provide adequate maintenance facilities and manpower. An eight-man crew handles fluorescent lighting maintenance—five men working from a specially designed monorail platform (fixtures are mounted



MONORAIL MAINTENANCE PLATFORM *accommodates a five-man relamping and servicing crew in this large Texas plane plant. Parts boxes mounted to platform hold spare lamps, starters, cleaning equipment and other necessary items.*



SKIP-AND-CLEAN *routing of the relamping and servicing crew provides balanced illumination with alternate bays equipped with new lamps while the intermediate ones have lamps with about half their useful life expired. Diagram shows movement of crew from trip to trip.*

S-h-h... it's a "civilian secret"!

New, improved MILLER 50 FOOT CANDLER and 100 FOOT CANDLER Continuous Fluorescent Lighting Systems coming back — look for the BIG NEWS here next month!

Three years ago we introduced the first continuous fluorescent lighting systems — MILLER 50 AND 100 FOOT CANDLER.

This meant that for the first time industry really could have adequate man-made daylight *indoors* — of 30, 50 or more footcandles — for better, faster, safer production.

This meant considerable *installation savings*—both time *and* dollars—over conventional incandescent or fluorescent fixture hookups. Savings of from 30 to 50% as a matter of fact.

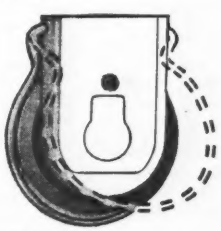
This meant *simplified lighting maintenance* — reflectors so easy to remove, handle and clean that women workers could take care of them.

Then war hit! And, cockeyed as it sounds, the very production requirements which this better lighting served so well created shortages in metals and other vital materials that temporarily cramped our style.

Now MILLER engineers have licked those headaches — and they're bouncing back with a new, and further improved 50 FOOT CANDLER AND 100 FOOT CANDLER that's going to give you all these lighting benefits to help you with your production and manpower problems.

If your war demands are so great you can't wait, drop us a line and we'll see what advance dope we can send you now.

THE ABOVE LIGHTING LAYOUT *will give you a faint hint of what's coming — an improved, streamlined version of the most successful lighting system in use in industry today — and pioneered by* MILLER.



SAFETY FIRST!
Among many noteworthy MILLER *fluorescent features is this patented* safety lamp lock *that minimizes the danger of lamps falling. It is an integral part of each socket, simple in operation, foolproof, and sound accident insurance.*

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

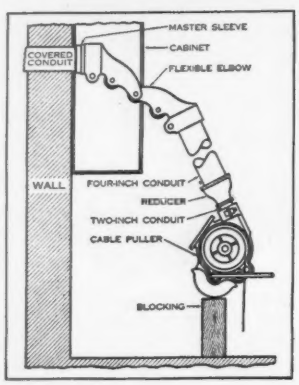
WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

UMI

HERE'S HOW TO PULL CABLE WITH A GREENLEE CABLE PULLER

● Here's a fast, easy method of pulling cable that saves hours of work and does away with heavy, cumbersome equipment. There is no wear and tear on conduit hangers and the many difficulties experienced with make-shift methods are eliminated. A few of the many features of this versatile tool are outlined below.



PULLING FROM EXPOSED CONDUIT

The Puller is securely clamped directly on conduit for two important reasons. One . . . the conduit affords a convenient, positive anchorage. Two . . . by attaching the Puller to the conduit, a holding force is applied to the conduit itself, through the channel-iron frame . . . a force that is equal to the outward pull of the cable. This prevents loosening of hangers. Tension Drum is adjustable on beam and swivels in a full circle, providing clearance in close quarters. Puller will also operate on vertical conduit.

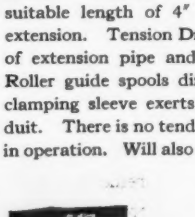
PULLING FROM CONCEALED CONDUIT

For concealed conduit, a flexible elbow attachment is used. One end, with a master sleeve, attaches to conduit and other end is attached to suitable length of 4" pipe, which serves as an extension. Tension Drum is assembled at tne end of extension pipe and supported with blocking. Roller guide spools direct the pulling force, and clamping sleeve exerts the holding force on conduit. There is no tendency for tool to rise upward in operation. Will also operate on vertical conduit.

OTHER SPECIFICATIONS

One man can operate, tool is portable, pays for itself on first few jobs. Has two-speed gearing — maximum pull 7500 pounds. Safety dog prevents unwinding. Cast parts semi-steel, cut steel gears, support frame — two 3" channel irons. Net weights: Detachable Drum Unit — 85 pounds. Complete Tool (less Elbow Unit) — 170 pounds. Flexible Elbow Attachment (optional equipment)—approximately 65 pounds.

For complete details write for Catalog 33E. Stock is available for essential users.



PULLING INTO JUNCTION BOX

Here the Puller is set up for pulling into a box from a vertical conduit. In this photo the tension drum is swivelled around from the position shown in the top picture. Special conduit adaptors are supplied for close quarters.

OTHER GREENLEE TOOLS SAVE HOURS OF WORK

BENDERS

For any bending job there's a Greenlee Bender. Small hand benders and powerful hydraulic benders for conduit, pipe and tubing from ¼ to 4½-inch size. They are easily operated by one man, save the cost of many manufactured bends, are easily carried to the job and set up.

KNOCKOUT TOOLS

Enlarge holes without long tedious drilling, reaming and filing with Greenlee Knockout Punches and Cutters. This handy tool is inserted in a knockout or a small drilled hole and a smooth accurate hole can be quickly cut by turning the drive nut with an ordinary wrench.

Greenlee TOOL CO.

1749 COLUMBIA AVE. • ROCKFORD, ILL.

WRITE FOR FREE COPY OF CATALOG 33E

in twin rows on each side of bottom of chord of trusses, so monorail system is utilized to advantage), one man in the cab to operate the crane and to supply lamps, rags, cleaning compound, etc., to four men on the platform, two on either side of the truss chord. Each side of the platform is equipped with a large parts box to hold lamps, starters, cleaning materials and other necessary items. Two men work on a fixture simultaneously, thus eliminating the danger of breaking lamps, bending sockets, etc. Two other crew men bring supplies from the storeroom and take away burnt out lamps, while a third takes his place on the catwalk to turn the power off and on. This full crew is on duty only on the third shift when the demand for the monorail for production purposes is lightest. Emergency crews only are used on the first and second shifts, except on Sundays, when larger crews catch up on miscellaneous and non-uniform lighting installations.

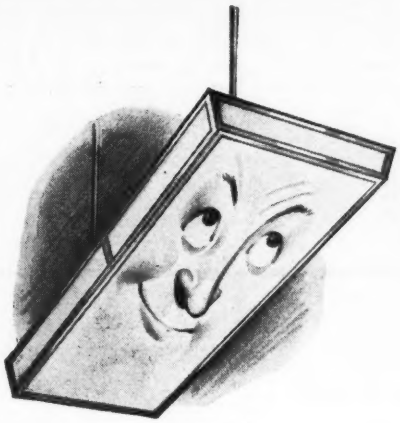
The system worked out by the maintenance engineers is known as the "skip-and-clean" method and is just what the term implies. As outlined in a talk presented before the A.I.E.E. and I.E.S., by C. F. Prideaux, the system works as follows:

The crew starts at Section One, in the southwest corner, relamping and cleaning all fixtures, using a paste cleaner and wiping with a damp cloth to prevent spilling water on the equipment and personnel below. It then skips Section Two and works on Section Three; skips Four and handles Five and so on. With every second section of the bay thus completely serviced, the crew moves back to the south end of the east side of the bay and services Sections 2, 4, 6, 8, etc.

After the large assembly bay has been completely serviced, the smaller 120-ft. bay is similarly lamped, then the parts building. By the time the last section has been completely cleaned and lamped, approximately 4000 hours have elapsed and it is time to start all over again. Although this time exceeds the 3000 hour allotted life of the lamps, actual experience has indicated that 4,000 hours of life is being obtained.

By this skip-and-clean method, a balanced level of illumination is provided with alternate sections of new lamps between those midway in their useful efficient life. Each lamp is dated by the relamping crew at the time of installation.

If lamps burn out prematurely, they are replaced with dated new ones. Such renewed lamps are removed in routine servicing. If the dates indicate a substantial unused lighting efficiency, they are placed in reserve to be used in future emergencies according to their useful life.



Wonder what a Fluorescent Fixture thinks about?

"Wonder what will happen to us fluorescent fixtures when the war is over? Wonder if a lot of us won't be back numbers with all the new stuff that is coming along?"

* * *

When the lights come on again there are going to be changes in fluorescent fixtures and in fluorescent lighting. Right now no one can tell just what these new fixtures will be like or whether light sources will be different . . . but of these things you can be sure:

1. Most Present Fluorescent Fixtures will be Obsolete

Post-war fixtures will be less bulky, lighter in weight, easier to install and maintain. They will be made of different, new materials—laminated and impregnated wood, lignin and laminated-lignin, paper plastics, synthetics and treated asbestos. Special new types of glass, magnesium alloyed steel and aluminum will also be used.

Fixtures of these new materials may easily be stronger, have better reflection factors, and stand up better under moist and corrosive atmospheres than pre-war fixtures did. New production methods learned during wartime should result in lower fixture prices. New designs may permit closer mounting to the ceiling . . . may permit flush-to-ceiling mounting.

2. Post-war Demand for Fluorescent Lighting will be Tremendous

Already there exists an unfilled demand for fluorescent lighting and the demand is constantly growing. There are many, many store, bank, office, and restaurant owners who would install fluorescent lighting today if they could get the necessary priorities. Add to their number those many people now enjoying fluorescent lighting in war plants who will return to their peacetime shops and businesses after the war. All these people will demand that they be sold fluorescent lighting. And they'll get it . . . even better lighting than they had in the war plants. Better because color quality of the light will be improved. Starters will be better. Fixtures will be made in smart, new designs tailored to every lighting purpose.

3. No Helter-skelter Selling of Fluorescent Lighting

No one knows just when the war will end, but of this we can be certain. *The moment priorities are lifted, lighting is one thing that can be sold almost immediately.* To be sure that *good* lighting is sold, local leadership is needed, leaders who have made plans for a brighter and better tomorrow. *Are you making your plans?*

G-E MAZDA LAMPS

GENERAL ELECTRIC

Hear the General Electric radio programs: The "Hour of Charm", Sunday, 10 p.m. EWT, NBC; "The World Today", news every weekday, 6:45 p.m., EWT, CBS.

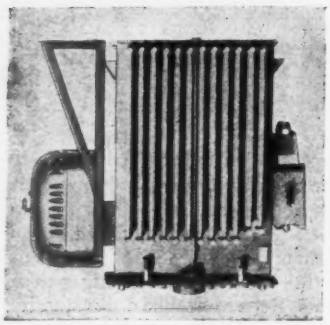
★ **GENERAL ELECTRIC EMPLOYEES ARE NOW BUYING $1,000,000 WORTH OF WAR BONDS EVERY WEEK** ★

UMI

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed descriptions, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of ELECTRICAL CONTRACTING you saw the item and they will send full details to you.

EQUIPMENT NEWS

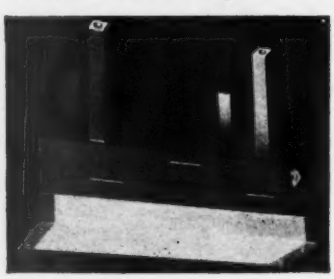
Load Center Unit Substation



G-E LOAD CENTER UNIT SUBSTATION

A line of load-center unit substations for semihazardous locations in oil refineries, chemical plants and other plants having similar conditions, has been announced. They are available in standard ratings from 100 to 1000 kva. at 480 volts and 100 to 500 kva. at 208/120Y or 240 volts. Units can be used indoors or outdoors for power and lighting service of 600 volts and below. Primary voltages from 2.4 to 15 kv. can be handled. The new line incorporates a liquid-filled primary disconnecting switch, standard Pyranol or oil-filled transformer section and a low voltage section with a 600 volt, removable air circuit breaker. All arcing parts are either liquid immersed or in enclosures of Class I, Group D, construction. The incoming line switch is mounted integral with the transformer section and is equipped for breaking transformer magnetizing current. General Electric Co., Schenectady, N. Y.

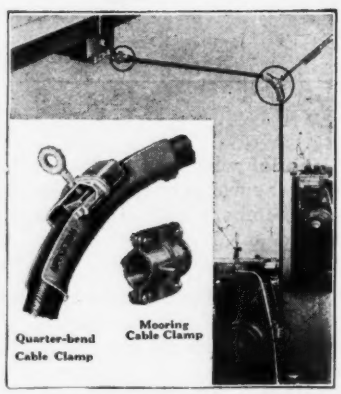
Fluorescent Fixture



CURTIS FLUORESCENT FIXTURE

A new fluorescent lighting fixture for marine use. As this unit is resistant to shock, vibration and oscillation, it is suitable for vessels and may be used in industrial plants where these factors must be taken into consideration. It uses two 15 watt fluorescent lamps. The tulamp ballast, lampholders, starter sockets and special terminal block can be removed from the housing as a complete unit, without dismounting fixture from the ceiling or from mounting brackets. The length of the unit is 18⅞-in., width 6⅛-in., depth 5¼-in. and mounting brackets 7½-in. deep. Curtis Lighting, Inc., 6135 West 65th Street, Chicago 38, Ill.

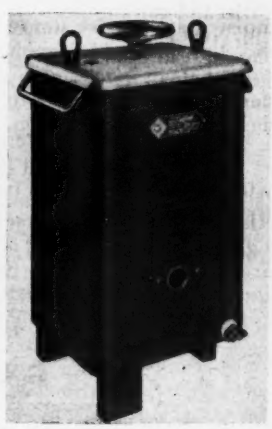
Cable Clamps



APPLETON CABLE CLAMPS

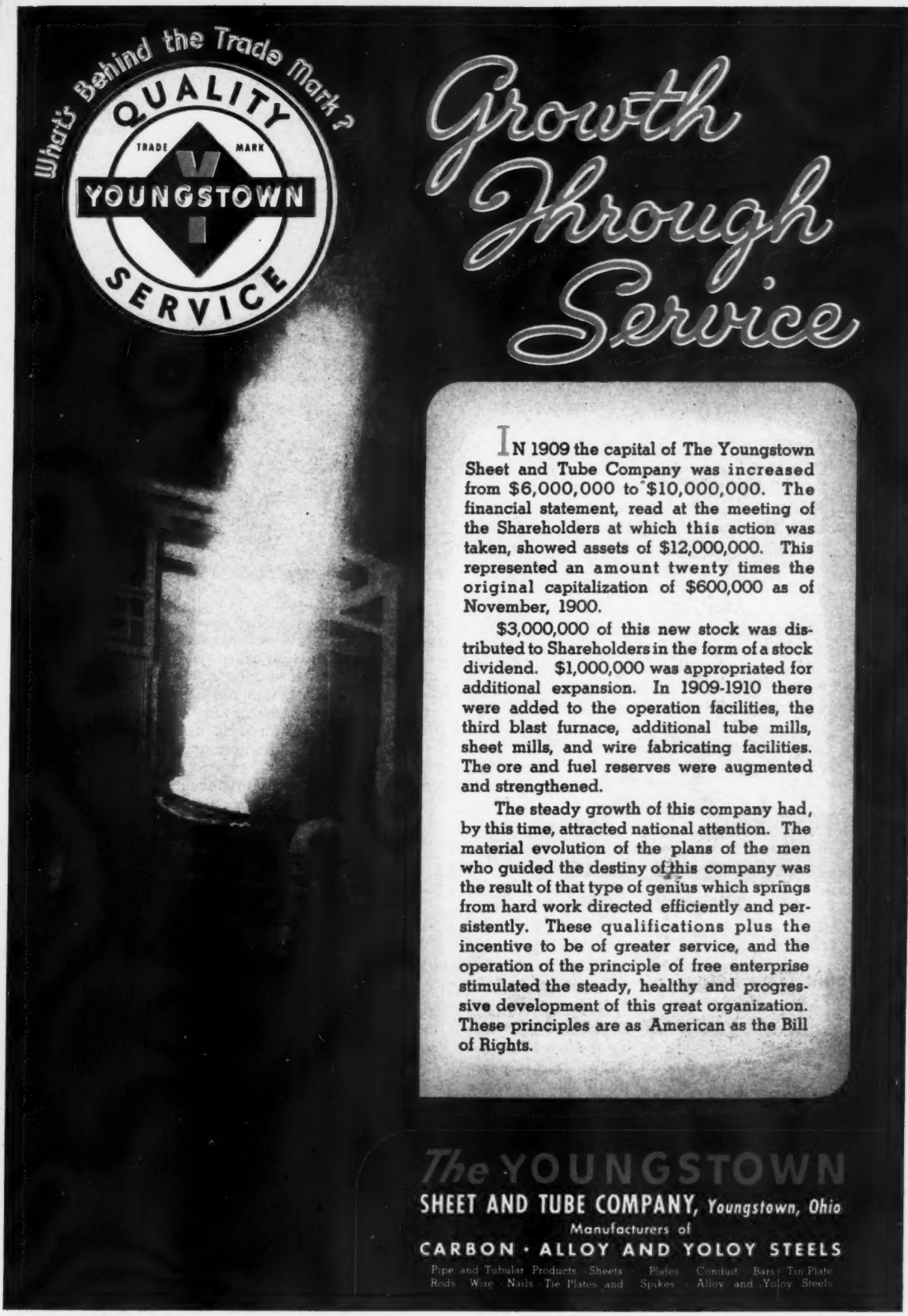
A line of new cable clamps for exposed industrial wiring has been announced. They are designed for use in making branch feeder installations without the use of rigid conduit. The flexibility of arrangement and mounting is desirable for mass machinery installations in industrial plants. The quarter-bend cable clamp provides the proper bending radius without injury to the cable. The mooring clamp is used to anchor cable at supply and output ends without strain on cable line. These clamps have been developed to provide a support for branch feeders from the main distribution system. Appleton Electric Company, 1701 Wellington Avenue, Chicago 13, Ill.

Alternating Current Welder



ALLIS-CHALMERS WELDER

A new alternating current welder, known as Ampac "200", has been announced. It automatically gives the operator correct voltage for the continuous range of currents available, rather than using an almost constant voltage at all current settings. The design and operating features include the new integrated reactor-transformer construction; active duty from every line of flux; simplified construction using fewer working parts. It has a range of current from 30 to 250 amperes, and it handles rods $\frac{1}{16}$ to $\frac{1}{4}$ inch in size, for thin sheets or heavier plates. Most d.c. rods as well as a.c. rods can be used. Allis-Chalmers Mfg. Co., Milwaukee, Wis.



Growth Through Service

IN 1909 the capital of The Youngstown Sheet and Tube Company was increased from $6,000,000 to $10,000,000. The financial statement, read at the meeting of the Shareholders at which this action was taken, showed assets of $12,000,000. This represented an amount twenty times the original capitalization of $600,000 as of November, 1900.

$3,000,000 of this new stock was distributed to Shareholders in the form of a stock dividend. $1,000,000 was appropriated for additional expansion. In 1909-1910 there were added to the operation facilities, the third blast furnace, additional tube mills, sheet mills, and wire fabricating facilities. The ore and fuel reserves were augmented and strengthened.

The steady growth of this company had, by this time, attracted national attention. The material evolution of the plans of the men who guided the destiny of this company was the result of that type of genius which springs from hard work directed efficiently and persistently. These qualifications plus the incentive to be of greater service, and the operation of the principle of free enterprise stimulated the steady, healthy and progressive development of this great organization. These principles are as American as the Bill of Rights.

The YOUNGSTOWN
SHEET AND TUBE COMPANY, Youngstown, Ohio
Manufacturers of
CARBON · ALLOY AND YOLOY STEELS
Pipe and Tubular Products · Sheets · Plates · Conduit · Bars · Tin Plate
Rods · Wire · Nails · Tie Plates and Spikes · Alloy and Yoloy Steels

UMI

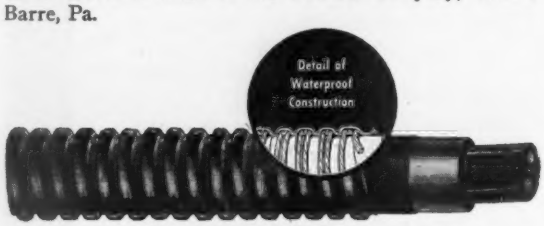
Fluorescent Unit

A new flexible arm fluorescent type of localized lighting unit has been designed for industrial work areas. The unit accommodates two 14-watt fluorescent lamps. It is equipped with lamp ballast and comes completely wired with switch mounted on top of housing. The reflector head of this model, called FLB, weighs 3 lbs. The reflector of non-metallic material is 15 1/16-in. long, 9-in. wide and 5 5/8-in. high. In excess of 100 foot-candles is provided for the critical work area by this model. The Fostoria Pressed Steel Corp., Fostoria, Ohio.

FOSTORIA FLUORESCENT UNIT

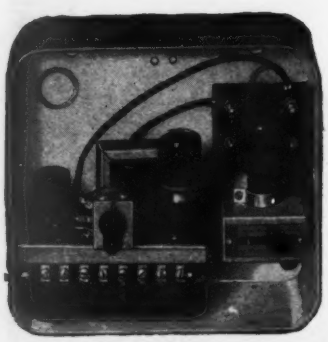
Waterproof Shipboard Cable

A new waterproof shipboard cable known as Loxsteel has been announced. It differs from previous designs only in the armor covering. It has a full interlocking metallic tape armor with smooth inner and outer surfaces and rounded arch. Also a double-packed seal, designed to prevent moisture from entering the metal tape armor or junction boxes. Conductors, insulations, tapes and lead sheath are made in accordance with A.I.E.E. specifications. Hazard Insulated Wire Works division of the Okonite Company, Wilkes-Barre, Pa.



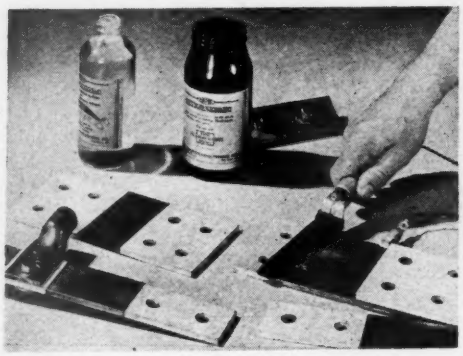
HAZARD LOXSTEEL

Electronic Time Relay



DURAKOOL ELECTRONIC TIME RELAY

This new adjustable electronic time relay is a combination of two hermetically sealed units, both of which are safe in explosive and corrosive atmospheres. The principle of operation is electronic, assuring freedom from trouble caused by mechanical lag or wear, and the load is carried by a quick acting mercury relay. Time settings are continuously variable within the range and may be adjusted to precisely the required operating point. Standard models cover time ranges from .05 to 0.5, 0.10 to 10. and 1. to 100. seconds respectively. Special models can be produced up to five minutes. Contact capacities are available up to 75 amperes, either normally open or normally closed. Durakool, Inc., 1010 N. Main St., Elkhart, Ind.



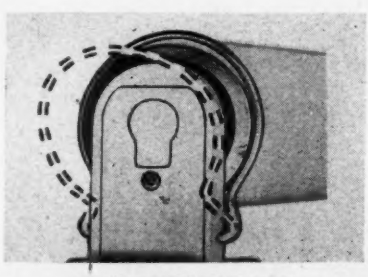
RAPID METAL-COATING PROCESS

Metal-Coating Process

This new metal-coating process has been developed to expedite application of the heavier silver coatings now specified on many government projects, for bus bars, lugs and other parts of electrical equipment. It is also for plating, replating or touching up rust and corrosion resistant coatings of other metals, on production lines or in the field. Available in silver, cadmium, tin, copper, zinc, nickel and gold. Plating current for small jobs can be obtained from dry batteries, storage battery or any convenient source supplying direct current at 3 to 6 volts. The plating rectifier can be connected to any 110-120 volt, 50-60 cycle a.c. circuit and will supply current for up to three applicators or operators. Rapid Electroplating Process, Inc., 1414 S. Wabash Ave., Chicago 5, Ill.

Safety Lamp Lock

This safety lamp lock is a part of each socket of the new Miller Aero-Designed fluorescent fixtures. This device minimizes the risk of lamps falling from sockets. Simple in construction, it is arranged so as not to interfere with fixture relamping and cleaning. It is a saving in time and money in industrial plants. The Miller Company, Meriden, Conn.



MILLER SAFETY LAMP LOCK

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION

"These boats are designed to strike and strike hard, to do damage where it will do the most good and quickly."
Such was the description of two sub-chasers today being fitted for service at Shelburne Harbor
SC1030

"Electrical fittings by Wesco"—190 of them

Products of 45 Manufacturers Assembled to Speed Historic Sub-Chaser Launching

When two 110-foot sub-chasers hit blue water recently, it was the first launching of combat vessels on Lake Champlain since the year 1812. Each sub-chaser's electrical fittings consisted of 190 separate items, ranging from a door switch to an automatic alarm system. Products of 45 manufacturers were involved.

Wesco ordered, assembled and delivered each set of 190 units—built to Navy specifications—before the deadline date. With Wesco as sole source of supply, complications, errors and expense were saved. The customer's office procedures were simplified by the elimination of 45 separate orders, 45 acknowledgments, 45 checks and countless follow-ups, bills of lading and invoices.

Once more, Wesco, trained in the quick assembly and delivery of every type of electrical product, helped speed war production. After Victory, this service-ability will again be yours to command as you convert to the business of peace.

WESCO SPEEDS WAR PRODUCTION

* On the frigid Northwest Coast 16 floodlights were urgently needed for lighting emergency airfields. The manufacturer required 10 weeks to make delivery. Wesco had the equipment on the way in 18 days.
* A flood ruined the machinery and electrical equipment of an important war plant. Wesco's prompt delivery of 22 electrical items made by 6 manufacturers saved this plant 28 days delay.

WESCO SERVES BUSINESS

* By offering prompt delivery of electrical items from local stocks.
* By maintaining perpetual inventory records.
* By providing trained sales and engineering personnel.

Westinghouse Electric Supply Co.

150 VARICK STREET . . NEW YORK (13), N. Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

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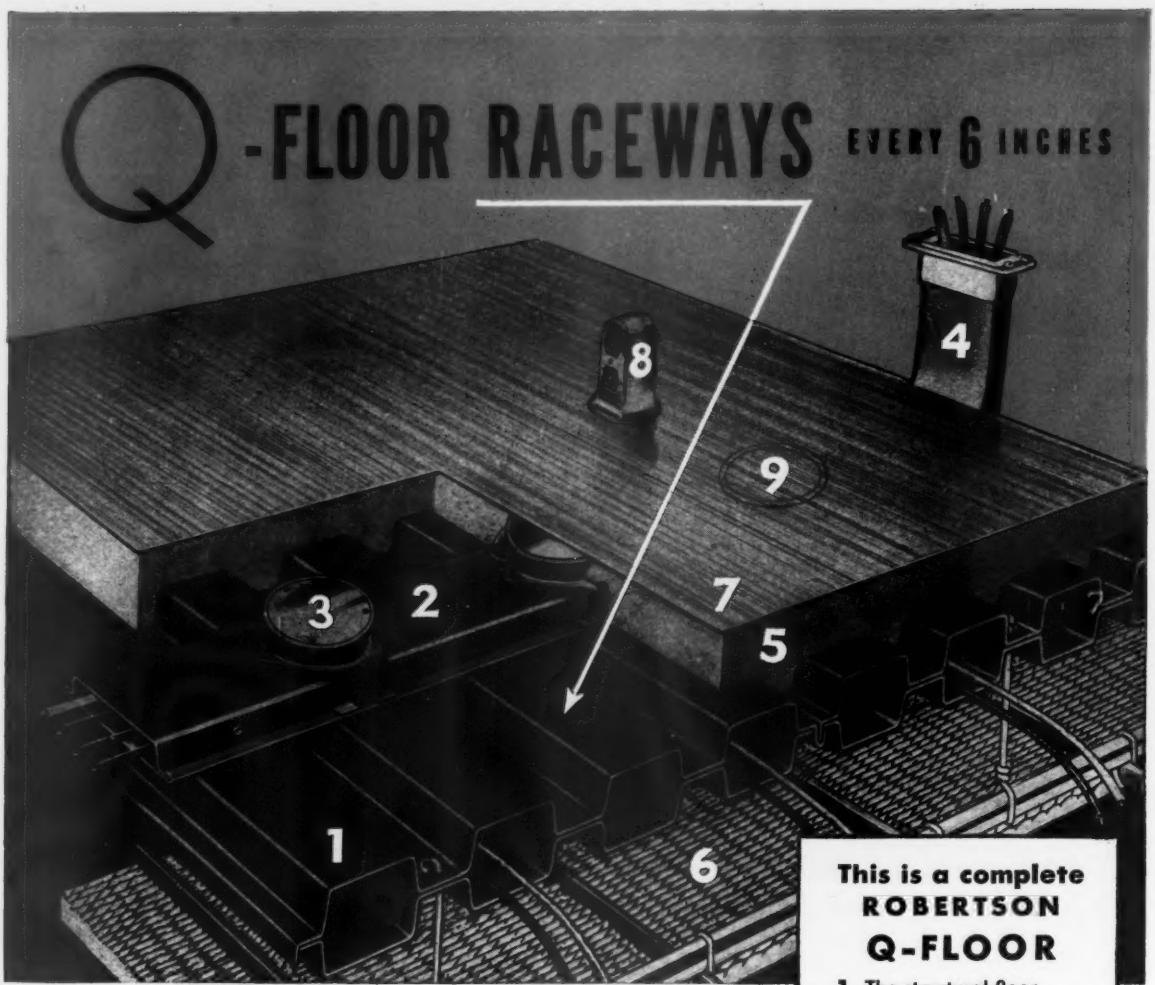


This is a complete ROBERTSON Q-FLOOR

1. The structural floor
2. The crossover raceway
3. The handhole (into the cell)
4. The ell connecting the crossover raceway with the panel box
5. The lightweight fill (usually 2½ inches)
6. The suspended ceiling (⅞-inch vermiculite plaster)
7. Floor finish (can be any type)
8. Floor outlet head (can be set anywhere)
9. Adapter plate, covering used handhole

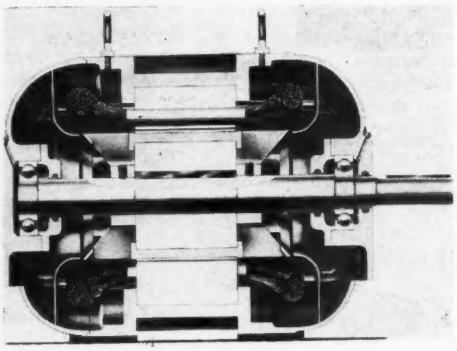
Think what it would mean to you...ELECTRICAL MAINTENANCE MEN . . . to have capacious, approved, electrical raceways, like this, every 6 inches throughout your entire floor system! And think what it would mean to have them easily accessible!

This is what Q-FLOORS have to offer. They provide complete electrical availability and are adaptable to all types of wiring covered in the National Electrical Code. They also provide for rearrangements and changes in any type of building wherever they are used.

Literature will be gladly furnished by General Electric Engineers. Contact the nearest General Electric merchandise distributor (in all principal cities).

H. H. ROBERTSON CO. · Farmers Bank Building · Pittsburgh, Pa.

ROBERTSON Q-FLOORS



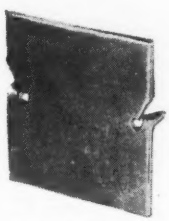
LIMA INDUCTION MOTOR

Drip Proof Induction Motor

A new RS drip-proof induction motor built in sizes from ½ to 75 hp. two or three phase, a.c. current. It has been designed to give maximum protection against chips and filings, dripping or splashing liquids. It is adaptable to machine tools and production equipment, canneries, paper mills, dairies, packing houses, and other locations where a totally enclosed motor is not especially needed. They are equipped with heavy duty ball bearings, heat treated ground shafts, dynamically balanced rotors, and rugged frames. Phase insulation is heavy varnished duck. The Lima Electric Motor Co., 2201 Findlay Road, Lima, Ohio.

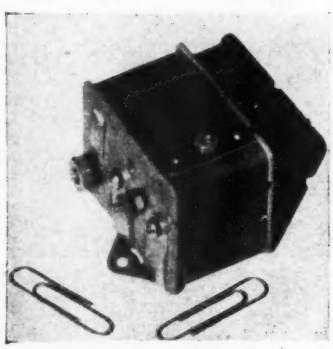
Protector Plate

This protector plate is a new and simple device to meet the demands of the National Electrical Code, Section 3017, Chapter 3. They are for use on all types of wiring installations, such as ripping away plaster, plasterboard, after completed installations, searching for short-circuited wires caused by driven nails, etc. Atlantic Conduit Fitting Co., 589 Atlantic Ave., Boston, Mass.



ATLANTIC CONDUIT PROTECTOR PLATE

Contractor



G-E CONTACTOR

This new contactor is specifically designed for aircraft applications where small size and lightweight are desirable. It is effective for controlling solenoids and small motors in aircraft. Contactor is furnished in two sizes — 50 amperes and 100 amperes. The 50 ampere type is $2\frac{15}{16}$ by 2 in. in size and weighs $4\frac{3}{4}$ ounces and the 100 ampere type is $2\frac{3}{4}$ by $2\frac{5}{8}$ in. and weighs 11 ounces. It can be mounted in any position on either a metal or non-metallic base. General Electric Co., Schenectady, N. Y.

Connectors

This new line of "Multifit" connectors includes straight connectors and reducers, tees, and terminal lugs. Every fitting can be used for a wide range of conductor sizes. Connectors grip the conductors by means of U-bolts with integral saddles, providing generous holding area and distributing the pressure on the conductor. There are straight connectors and reducers with 2, 4 or more bolts; tees with 1 or 2 bolts on run and tap; terminals with any number of bolts, straight or angle flanges, variously drilled. Each made for a complete range of cable sizes up to 2,000,000 cm. Lock washers give protection against vibration, preventing loosening of bolts under any conditions of use. Penn-Union Electric Corporation, Erie, Pa.

PENN-UNION CONNECTORS

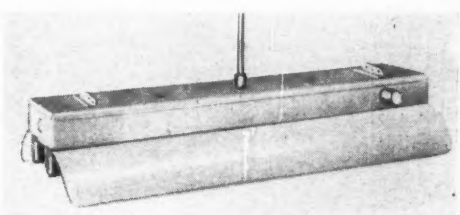
Terminal Puller

A new bearing and battery terminal puller, known as Steelgrip No. 13 and 13A, has been announced. This is in addition to their regular line of gear and wheel pullers. It is made in two sizes—2-in. and 5-in. reach. The arms are drop forged, heat-treated steel, of great strength. The hooks are thin so that they will fit between bearings and motor housings and long enough to reach the bearing race. It is for use wherever motors, machinery or machines are in operation. Armstrong-Bray & Co., 5364 Northwest Highway, Chicago, Ill.

ARMSTRONG-BRAY TERMINAL PULLER

Fluorescent Unit

This new lightweight fluorescent unit is recommended for high intensity, localized lighting of production, assembly and inspection lines and for lighting over benches, machines, tables. Unit comes complete with six foot cord and plug. Knockouts are provided for rigid conduit mounting, singly, in twin groups or continuous rows. Unit uses two 20 watt fluorescent lamps. Reflector is made of "Lumenite," a durable, moisture-resistant composition. It has latest type ballasts, sockets and FS-2 starters. Units operate on 110-125 volts, 60 cycles, a.c. Mitchell Manufacturing Company, 2525 N. Clybourn St., Chicago, Ill.



MITCHELL INDUSTRIAL UNIT

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Fluorescent Lamp Ballast

ACME FLUORESCENT LAMP BALLAST

These new air-cooled type fluorescent lamp ballasts were designed for exposed mounting on fluorescent lamp fixtures to save metal or material in housing the ballast and other accessories. It differs from the conventional design in that the leads are brought out through outlets in the base plate. It is claimed that because of the exposed installation, these ballasts will operate at lower ambient temperatures than enclosed type ballasts. Available in ratings of 40 to 100 watts for single, two, three and four lamp fixtures. The Acme Electric & Manufacturing Co., Cuba, New York.

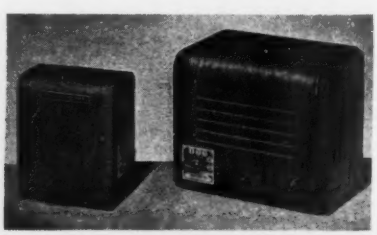
Rechargeable Flashlight Battery

This rechargeable storage battery for flashlights is not only for industrial and utility service but wherever flashlights are required in regular use. It is small in size to fit all popular two cell, 1½-inch size D flashlight cases. Each battery can replace up to 400 or more dry cells. This is possible by recharging at convenient periods. Battery charges are available for this purpose, both in single and gang types—for use on both alternating and direct current. Ideal Commutator Dresser Company, 1041 Park Avenue, Sycamore, Ill.

IDEAL BATTERY

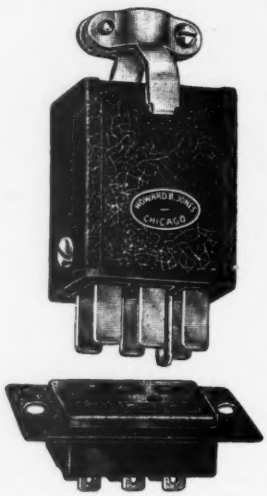
Inter-Communication Equipment

A new inter-communication system known as Model LP-77. It utilizes in any combination up to ten, both master stations and a new selector-type sub-station. Master stations may carry on a private conversation between each other without interruption or eaves-dropping by the remote stations, and in addition, may communicate with the different sub-stations at will. Any master station may also have a private sub-station with which no other master can communicate or listen in on. A flexible inter-office communication system may be had with instant contact to all vital points without the use of a central switchboard operator. Systems may be built up progressively beginning with two units to any amount of stations desired. Stations can be placed at any distance up to 2000 ft. from each other. It operates on 110 volts, a.c. or d.c. The Talk-A-Phone Mfg. Co., 1219 W VanBuren St., Chicago, Ill.



TALK-A-PHONE INTERCOMMUNICATION SYSTEM

Plugs and Sockets

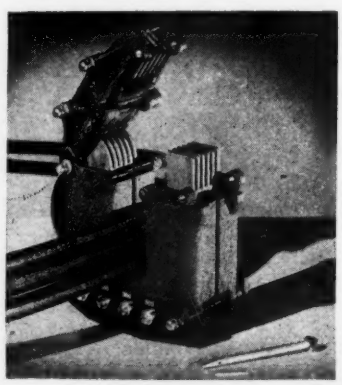


JONES PLUGS AND SOCKETS

A new series of multi-contact plugs and sockets, known as the No. 2400 Series, has been announced. This new line is interchangeable with the present No. 400 Series. Sizes range 2, 4, 6, 8, 10 and 12 contacts and are furnished with either a shallow bracket for flush mounting, deep bracket for recessed mounting or with metal cap with or without cable clamps. Both plug and socket bodies are of identical size and interchangeable with either cap or bracket. Four individual flexing surfaces make contact with each plug prong. Each segment makes positive contact over practically entire surface providing increased contact area and smoother action. Projections on all four sides of the socket contact lock it into position when forced into contact pocket. Howard B. Jones, 2460 W. George Street, Chicago 18, Ill.

Split-Core Current Transformer

A new split-core current transformer for use in connection with graphic instruments. It is designed for a ten volt-ampere burden. The phase angle errors have been held low by the use of the method of interweaving the laminations at the joints in the core. It is for use with graphic a.c. ammeters. Where it is impossible to open the circuit and where extreme accuracy is not required, it may be used with graphic wattmeters, except on circuits of low power factor. Each transformer has three primary ranges, 150, 300 and 600 amperes. Secondary current 5 amperes. The over-all dimensions are $6\frac{7}{16}$-in. long by $6\frac{5}{8}$-in. high by $4\frac{3}{16}$-in. thick. The Esterline-Angus Company, Inc., Indianapolis, Ind.



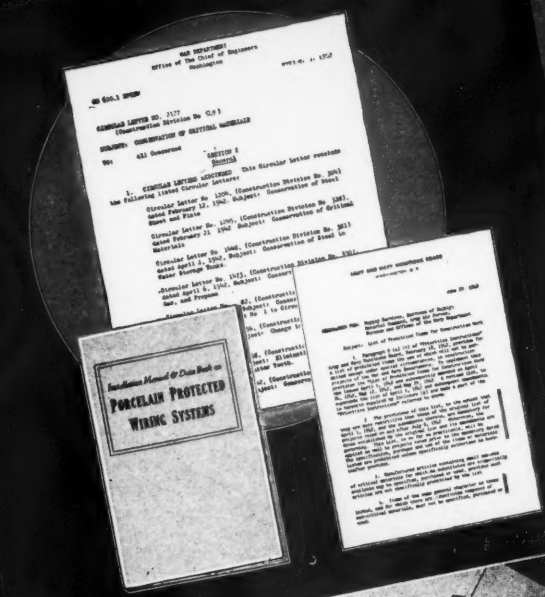
ESTERLINE-ANGUS TRANSFORMER

You Can Handle and Speed

WIRING JOBS

FOR CANTONMENTS DEPOTS AND OTHER WAR CONSTRUCTION

USE MODERN PORCELAIN PROTECTED WIRING SYSTEMS

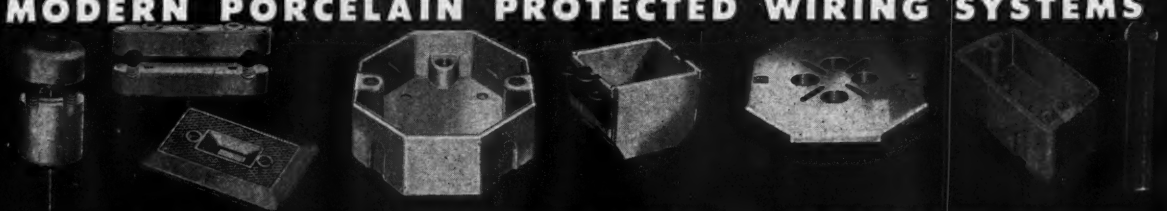


★ In using porcelain you not only fully comply with directives issued by W.P.B., Army and Navy Munitions Board, and War Department but you have the material for doing modern, adequate, complete and permanent jobs. Porcelain is not a critical material and therefore these various government agencies authorize its full usage and depend on porcelain to meet all war construction needs and save vital metal and rubber.

In use for 50 years Porcelain products are today demonstrating their great value more than ever before. It is suggested that you keep porcelain in mind for post war wiring.

Porcelain Protected Wiring Systems offer many advantages to both contractor and customer. For example, quick installations are accomplished—economical results are realized—complete insulation and protection from the entrance switch to the very last outlet on the system—short-proof and shock-proof qualities of porcelain contribute to dependability—rust and corrosion resistance characteristics make porcelain the ideal material in damp, wet, or dry locations—porcelain gives you permanency. For details write to the companies listed below.

MODERN PORCELAIN PROTECTED WIRING SYSTEMS



★ ILLINOIS ELECTRIC PORCELAIN CO. ★ KNOX PORCELAIN CORPORATION ★ PORCELAIN PRODUCTS, INCORPORATED

UMI

IN THE NEWS

ELECTRICAL WORK ON DRAFT DEFERRED LIST

Manpower requirements, not only in the Armed Services but also in essential industries, have been the primary considerations in the new Selective Service System classifications. The criterion is no longer dependency (except in certain hardship cases) but essential to the war effort. The electrical construction and maintenance industry as a whole has been and still is on the list of essential activities issued by the War Manpower Commission.

In addition to a series of changes in the rules for inducting men into the services, control has been placed on the transfer of workers to war industry and for holding necessary workers in war production.

These are the steps which the War Manpower Commission is taking:

1. Establishment of a list of critical occupations covering skills urgently needed in the war effort. Workers possessing such skills must get into war industry or supporting civilian activities by October 1 or lose further claim to Selective Service occupational deferment. In order to insure accurate channeling of workers with these critical skills to the most urgent war jobs, provision is made for their hiring only upon referral by or with consent of the U. S. Employment Service.

2. Selective Service local boards were instructed to give greater consideration than ever before to occupational deferment. In determining the "replaceability" of a worker the boards are instructed to consider the actual and immediate effect of his induction on vital production. They are to take into account not merely the national shortage of his skill, but available replacements for even unskilled workers and current local shortages of skilled or unskilled labor. Closer collaboration is provided between the local Selective Service Boards and the offices of the U. S. Employment Service in making these determinations.

3. Establishment of new standards for permitting the transfer of civilian workers from job to job. These standards are based on experience under employment stabilization plans and will be written into all such plans by October 15. They are intended to stimulate transfer from less essential to more essential war jobs, and to reduce the unnecessary shifting of workers from job to job which has pyramided turnover and interferred with vital production in many plants. At the same time broad powers to determine when a transfer is in the interest of the war effort are given to local and regional WMC offices.

4. Extension of the list of non-deferrable activities and occupations, providing that all men of military age must transfer from such jobs or be placed first on the list for induction by local boards. The first fathers to be drafted will be those who are contributing least to the war effort.

There are 149 occupations listed in the newly established critical list. On the revised non-deferrable list are 60 occupations and 58 activities.

The new list of critical occupations contains skills urgently needed in war industry and supporting civilian activity. Men with those skills who are not in essential industry at present should register with their local employment offices and make themselves available to take essential jobs. If they do not agree to transfer when called, they will be subject to reclassification so that they will be available to the military forces which also need skilled men.

In a move designed to insure the accurate channeling of critical skills to the most urgent jobs, the regulation provides that workers in the newly announced group of 149 critical occupations may not be hired merely on the presentation of a statement of availability. "Referral by" or the "consent of" the United States Employment Service is required to employ them.

The non-deferrable list will serve to make more men currently available to war-useful activities and will enable the military calls to be filled with a minimum of disruption to production.

Included in the list of critical occupations are:

Cable Splicers, Telephone, Telegraph or Submarie Cable

Electrical Testers, Power Equipment

Electricians, Installation and Maintenance, All Around

Electricians, Aircraft, Marine, Power House, or Submarine Cable, All Around

Engineering Draftsmen, Design

Foremen who supervise directly or through subordinate foremen

Inspectors

Linemen, Telephone, Telegraph, or Power, All Around

Switchboard Operators, Power

X-Ray Equipment Servicemen

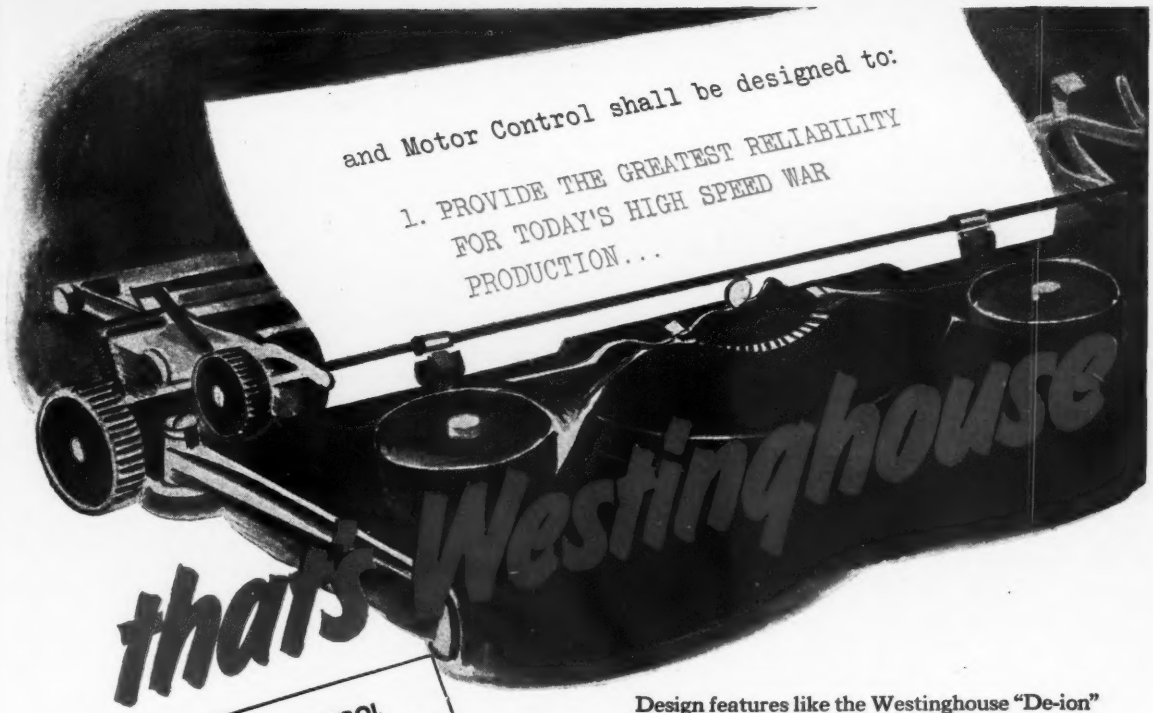
Professional or Technical Communication and Electrical Engineers.

Employees of contractor organizations are specifically covered under construction of approved industrial plants, houses, hospitals and military projects; repair of such facilities and services necessary to complete such construction.

Motor shop men and industrial electricians are specifically covered under repair services which include industrial, commercial and domestic electrical installations, maintenance and repair, welding service, armature rewinding, appliance elevator and motor repair, and repair of farm and other industrial and scientific equipment.

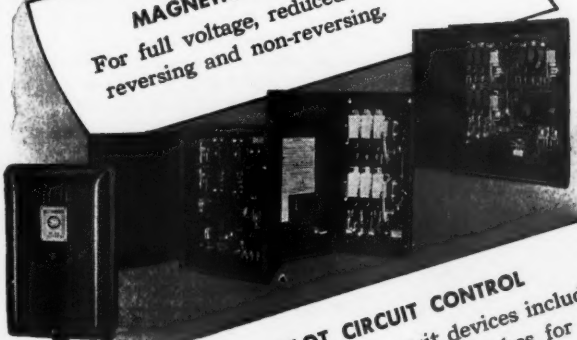
There is considerable overlap in that many of our men, due to their diversity of skills, will be covered on more than one count. This speaks well for the part played by our industry in the war effort.

"I haven't been bothered with a single day of absenteeism since I hired her."

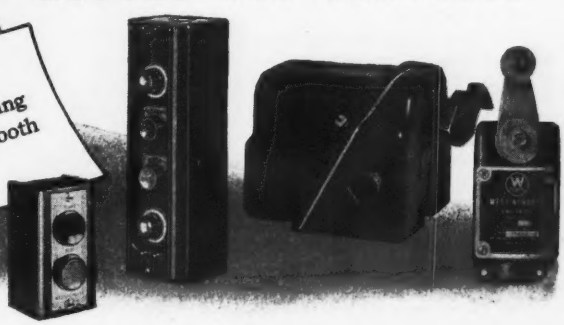

and Motor Control shall be designed to:
1. PROVIDE THE GREATEST RELIABILITY FOR TODAY'S HIGH SPEED WAR PRODUCTION...
that's Westinghouse

MANUAL MOTOR CONTROL
For full voltage, reduced voltage, or step starting, speed regulating, reversing and non-reversing.

MAGNETIC MOTOR STARTERS
For full voltage, reduced voltage, step, reversing and non-reversing.



PILOT CIRCUIT CONTROL
All types of Pilot circuit devices including push buttons and limit switches for both standard and heavy-duty service.



Design features like the Westinghouse "De-ion" principle of arc extinction are certainly a common-sense "must". And today's production goals need the kind of protection that the Bi-metal overload relay can give. The Westinghouse line of a-c and d-c motor controls is complete for motor types that meet requirements of a wide variety of applications.

So when you need motor controls — write "Westinghouse" in the specifications. Then get your Westinghouse representative on the phone. He'll help you all the way from application to installation. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-21270

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

MOTORS AND CONTROLS

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FLUORESCENT ORDER L-78 AMENDED

Industrial portable fluorescent fixtures, defined as mechanic's lamps or any portable lamps used in conjunction with industrial equipment, have been exempt from metal weight limitations. Fluorescent fixtures for use in hazardous locations as defined in paragraphs 5005 and 5006 of the National Electrical Code and fixtures to be used on board ship have also been exempt from metal weight limitations and restrictions.

After December 1, fixtures for office and drafting room use, termed non-industrial, may be manufactured subject to specified weight limitations. Fluorescent fixtures for present their manufacture is prohibited except by specific authorization. The demand for them has been met by drawing on stock produced before June 1, 1942 and the change has been made since inventories are expected to be exhausted by December 1.

The manufacture of certain types of industrial fixtures formerly permitted is now prohibited, and weight limitations on metals have been extended to include all permitted industrial types with above exceptions.

The sale of fixtures between manufacturers and distributors has been limited to rated orders only. The provisions of the earlier order whereby a retailer may make application for authority to sell his inventory without ratings has been eliminated. Depletion of retail inventories was said to have made this provision unnecessary.

Delivery of fixtures and component parts for storage has been prohibited but may be made for test and demonstration purposes.

These provisions are the result of an amendment to General Limitation Order L-78.

ELEVATOR MAINTENANCE AND REPAIR PARTS

Interpretation No. 1 of General Conservation Order L-89 clarifies two instances where no authorization is required for elevator maintenance and repair parts.

An authorization on PD-411 is not required, under the terms of paragraph (e), for the two classes of orders for maintenance and repair parts described below:

(1) An order for spare or maintenance parts is exempt if the parts inventory of the purchaser is not increased beyond $25.00 for each elevator operated by him and if his total purchases of such parts do not exceed $50.00 for each elevator in any calendar year. This exemption includes small maintenance or replacement parts, even though there may be some change in type, if the parts are necessary to keep the elevator in sound working condition. Examples: Replacement of a worn out gate switch of an obsolete type no longer manufactured, with a gate switch of a different type; or the use of a grease fitting on a bearing to provide proper lubrication.

(2) An order for repair parts in case of an actual breakdown or suspension of operations of an elevator is exempt where the essential repair parts are not available from the owner's inventory of spare or maintenance parts. A suspension of operations may be considered to have occurred if the condition of the cables or of other parts would make it definitely dangerous to continue the operation of the elevator without making the repairs; and such condition may be assumed where the cables or other parts have been condemned pursuant to a state law or municipal ordinance, requiring suspension of operations unless replacement of cables or other parts is made within the period (normally 30 to 90 days) specified on the inspector's report. However, a possible future breakdown cannot be considered within the exemption, nor can any parts for a change in the existing method of operation or control, or any parts for additions to existing elevators, merely to comply with so-called "Code Requirements" be acquired without authorization on a WPB-1236 (PD-411) Form.

In order to avoid a violation of the restrictions, the seller should satisfy himself that the parts ordered are within the $25.00 and $50.00 exemptions, or are needed for immediate repair due to an actual breakdown or suspension of operations.

The $25.00 and $50.00 limitations refer to the retail sales value of the parts ordered, exclusive of the cost of labor and personal services required.

A person whose maintenance requirements cannot be adequately met under the exemption of paragraph (e) (1) of the order may submit an application on PD-411 to obtain a larger quantity of parts.

FPHA CLARIFIES NON-DISCRIMINATION POLICY

The Federal Public Housing Authority's non-discrimination construction labor policy has been clarified to enlighten all contractors as to that agency's strict adherence to the President's latest executive order on fair employment practice.

FPHA Commissioner Herbert Emmerich declared that the agency's regulations were amended to include sub-contracts as well as direct contracts for construction of publicly financed war housing projects. The regulations also extend the non-discrimination provisions to applicants for employment on war housing projects as well as to persons already employed by contractors or subcontractors.

In addition, the directive immediately affects all FPHA construction work "off the site" as well as work "on the site."

Although prior rulings have generally defined the term "contractor" to include "sub-contractors" the new regulation now specifically inserts the non-discrimination clause into all sub-contract documents. All contract documents for work on war housing will carry the following instruction:

"There shall be no discrimination by reason of race, creed, color, national origin or political affiliations, against any employee or applicant for employment, qualified by training and experience, for work in the development of war housing.

"The contractor shall include the foregoing provision in all sub-contracts for any part of the work of this contract."

The provisions in the FPHA order for the determination of compliance by the use of percentage criteria are not changed. They require that the proportion of the total amounts paid for skilled and unskilled labor received by negroes and whites working on war housing projects must approximate the respective percentages of negro and white skilled and unskilled laborers living in the locality.

METHODS AND MATERIALS report at the Kentucky Chapter, IAEI meeting is discussed by chairman of the committee, Walter D. Roach, Louisville (left) and Wm. C. Krauth, Wm. C. Krauth Electric Co., Louisville.

WIRE AND CABLE CEILING PRICES

Provisions have been made for the individual adjustment of ceiling prices for producers and sellers of wire, cable and cable accessories similar to adjustment provisions recently made available to manufacturers of essential machinery.

The action, contained in Amendment No. 4 to Revised Price Schedule 82 (Wire, Cable and Cable Accessories) is confined to cases qualifying under rigid tests of essentiality of the seller and the product.

Since wire and cable are not consumer articles any increase in price granted by OPA in accordance with the action would not be reflected in the cost-of-living. Any increase in the cost of producing consumer articles made of wire or cable would be infinitesimal and would not affect consumer price levels, OPA stated.

The new adjustment provisions are substantially the same as set forth in Amendment No. 78 to Maximum Price Regulation No. 136 which became effective April 10, 1943.

The tests of essentiality are specifically spelled out in the amendment as are various cost, price, and competitive data factors which OPA will consider in reviewing the applications for adjustment.

Generally, the new provisions will permit OPA to adjust prices after it has ascertained that ceiling prices are at such a level that supply of vital wire or cable is impeded or threatened provided that the adjusted price will not cause an increase in the cost of living.

WPB URGES LOCAL MOTOR REPAIR

Advisory Committee members of the electric motor industry reported that a system of small motor replacement had been perfected to replace worn out motors with repaired or rebuilt units. However, WPB strongly urged that local repair facilities be maintained to ease the burden of shipping motors to and from factory sources.

A substantial increase in the number of fractional horsepower motors now being shipped to farm equipment manufacturers and direct to farmers was reported to the WPB at a recent committee meeting.

Both May and June shipping figures and shipping promises from motive power manufacturers to farm equipment manufacturers and farmers show a decided upward trend.

CERTAIN COPPER INVENTORIES AVAILABLE

Brass and mill and copper wire mill products are available through the Copper Recovery Corporation for manufacturers using copper or copper base alloy materials in the production of permitted civilian goods.

Sizable frozen or excess inventories of such brass and copper products lie unused in manufacturers' hands and, it was emphasized, producers in many instances stand to benefit through availing themselves of the service offered by the Copper Recovery Corporation in routing this material into civilian channels.

Officials of the Consumers Durable Goods Division said that the frozen and excess inventory stocks are usable in their present form by manufacturers of some consumer goods. Use of the material in the fabricated state would make unnecessary the remelting of the stocks, and would also minimize interference with the war production schedules of mills making copper products as a result of fulfillment of civilian needs.

The Copper Recovery Corporation compiles information on the amount, kinds, and location of frozen or excess stocks and expedites their transfer to manufacturers able to use them.

In making copper available in this manner the Copper Recovery Corporation acts merely as an agent. The material itself is purchased directly from the owner. Price terms and other details of the purchase agreement must be arranged between the buyer and seller, subject, of course, to OPA regulations.

Manufacturers desiring information about frozen or excess copper stocks can obtain lists of the quantities and kinds available from regional offices of the War Production Board. If the manufacturer has specific requirements, he should write directly to the Copper Recovery Corporation, 200 Madison Avenue, New York. A regular form, PD-595, is available for submitting requests but does not have to be used if all relevant information is contained in a letter. The manufacturer should state his CMP allotment number, together with the weight, description, size and alloy of the material he requires.

1. "So my youngster says to me, 'Pop, what are you doing to win the war?'"
2. "I wish my kid would ask simple questions like that."
3. "Yeah, that was easy. All you had to say was we're the guys . . ."
4. ". . . who keep electrical apparatus on the job for steady war production."
5. "You fellows talk too much. Hurry up with those jobs so I can put a red coat on them."
Buy WAR BONDS
CLOTH
TAPE
VARNISH
120
SAFETY FIRST!

PROTECTING ELECTRICAL APPARATUS FOR LONGER LIFE

There's a G-E Insulation for Every Need

These are only 5 of a complete line of insulation materials designed for service under all conditions. For detailed information, write to Section M932-8, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

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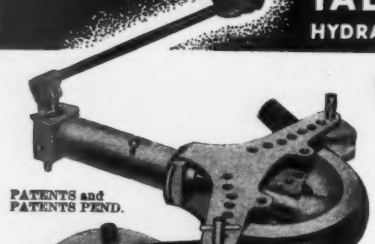
TAL'S *Prestal*
HYDRAULIC PORTABLE



PATENTS and PATENTS PEND.

PIPE BENDER

for steel pipe and conduit from ⅜" to 4½"

- NO HEATING
- NO FILLING
- NO KINKS
- NO WRINKLES

Make your offsets and bends up to 90° (and more) in one single, simple operation in a few minutes.

The pipe is NOT MOVED during the bending thus avoiding kinks and wrinkles. All bends—one or 1000 all identical and perfectly uniform even if made by "green hands."

Quick changeover to various sizes. Few seconds to mount and dismount. FASTEST PORTABLE BENDER!

SMOOTHNESS OF BENDS:

No wrinkles—no kinks—no breaking of pipe due to scientific development of bending formers. No job too complicated.

Obtainable in three different sizes
Meets U. S. Navy, Army & Maritime Comm. Specifications
Write today for circular giving complete description

TAL'S PRESTAL BENDER, INC.
Dept. E9 Milwaukee, Wisconsin

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ARMATURE

★ Binding Wire ★

Also high and low carbon steel wire—round, flat or shaped, in a variety of sizes, tempers, grades and finishes. Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y. or Buffalo, Chicago, Detroit, Philadelphia, San Francisco, Worcester.

Tinned, high tensile wire available in all grades
Prompt deliveries

WISSCO PRODUCT

WISSCO WIRE
BY WICKWIRE SPENCER

METAL IN HOUSING CUT 80 PERCENT

Savings ranging up to 80 percent in use of critical metals as compared with pre-war levels have been accomplished in the war housing construction program through joint cooperation of the government and the building industry.

Studies recently completed by the National Housing Agency show that the average privately financed family dwelling unit now being built under the war housing program consumes only 2,749 pounds of critical metals as compared with 8,390 pounds of such materials used in the average pre-war dwelling unit, a reduction of 69 percent.

These statistics include not only the metals used directly in house building but also the metals consumed in products and equipment installed in the housing and in related utility facilities such as electric, gas, water and sewage connections.

In the publicly financed phase of the war housing program, family dwelling units of permanent type built during the fiscal year ended June 30, 1943, consumed an average of 2,717 pounds of critical metals. This was a reduction of 72 percent from the 9,712 pounds used in the average pre-war publicly financed family dwelling and of 49 percent from the 5,370 pounds consumed in the average family dwelling built with public funds in the preceding fiscal year.

Still greater savings have been accomplished in family units of temporary construction. Substantially all the war housing now being built with government funds, is of this type. The average temporary family unit uses only 1,989 pounds of critical metals, a saving of 80 percent as compared with pre-war public housing.

Under the NHA's war housing program policies, privately financed construction is scheduled wherever a postwar demand for the housing is reasonably likely and wherever private builders can meet necessary wartime requirements. As privately financed war housing is therefore intended for long-term use, substitutions for metal items cannot be made on the same scale as in temporary structures intended only for wartime use.

FARM WIRING and its existing problems are reviewed by (L to R) A. L. Racke, contractor, Alexandria, Ky., G. L. Bridwell, manager, Harrison County REA, Cynthiana, Ky.; and R. J. Heffernan, contractor, Louisville, Ky.; at an off-side huddle at the recent meeting of the Kentucky Chapter IAEI in Cincinnati, Ohio.

INTERPRETATION MPR-251

This interpretation covers the case where an electric or gas utility company installs electric lines or gas mains at cost for industrial customers, farmers, the Army or Navy. If the gas mains or electric lines become the property of the customers after construction and if the charges for the material and services are on a non-profit basis but include indirect costs and overhead, the sale of the materials and services is subject to Regulation No. 251.

Supplementary Order No. 38 (Accommodation Sales of Service) is not applicable since the transactions are not "accommodation sales of services" under that order. Sales to the Army and Navy are exempt pursuant to Section 1387.53 (f) of Regulation No. 251.

FREIGHT CHARGES ON FARM EQUIPMENT

Farm equipment retailers may pass on to consumers the actual transportation charges incurred by them instead of "average combined freight charges."

The action, taken in Amendment No. 5 to Maximum Price Regulation 133 (Retail Prices for Farm Equipment) not only simplifies the former provisions for determining freight charges the dealers were allowed to include in their selling prices but also reflects OPA's recognition of changes to the industry's customary manner of shipment brought about by wartime conditions.

Under former provisions, the cost of transportation a dealer was permitted to pass on was based on a three months "average combined freight" paid by the dealer per hundredweight from factory to dealer on all complete items of farm equipment of the same general type. The cost of transportation in cases where shipment was made to the dealer from a branch house or transfer point could not exceed the carload freight from factory to the branch house plus the actual less-than-carload freight from branch house to dealer.

LORD NEGOTIATION PLAN TO GO TO CONGRESS

A bill to junk the traditional method of competitive bidding for the award of government construction contracts and to substitute a method of negotiated bidding will be introduced when Congress reconvenes next month.

The bill is based on a plan evolved by F. W. Lord, founder of the Lord Electric Company, New York. Lord asserts his plan would prevent collusive bidding, price fixing, over charging and profiteering.

Under the plan, the federal procurement agency would negotiate a lump sum contract for any given construction with a single contractor chosen as best fitted to do the job. The contractor would be chosen on the basis of questionnaires, advertisements or invitation. The govern-

Industrialists, with lighting problems are looking to silvered-glass reflectors for the answer. PERMAFLECTORS – the silvered-glass reflectors with the **permanent** reflecting surface – offer many advantages:

Fact One PERMAFLECTORS are highly-efficient **shaped mirrors.** They pick up the maximum flux of light and deliver it where it is needed and wanted. They provide engineered light control in desired concentrated, medium, or broad distribution.

Fact Two PERMAFLECTORS permit a wide range of mountings – from 6 to 60 feet, (and more), above floor level – on side walls – or on the work itself – for General, Directional, or Localized Lighting. Simply, inexpensively installed.

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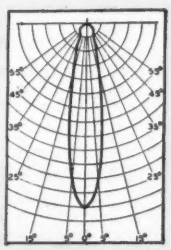
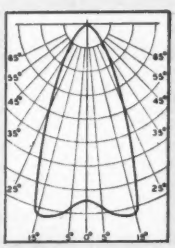
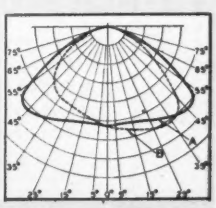
Investigate PERMAFLECTORS for your next lighting job. Write to Permaflector engineering headquarters at Pittsburgh, or let us send our representative to see you.



CONCENTRATED DISTRIBUTION Permaflectors for high mountings—from 25' to 60'.



MEDIUM DISTRIBUTION Permaflectors for mountings of from 15' to 25'



BROAD DISTRIBUTION Permaflectors for "horizon" mounting, 15' or less from floor.

PITTSBURGH REFLECTOR CO.
OLIVER BLDG. PITTSBURGH, PA.

Please rush complete data on Permaflector Industrial Lighting Units. EC 9-43.

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ADDRESS.....

CITY.....STATE.....

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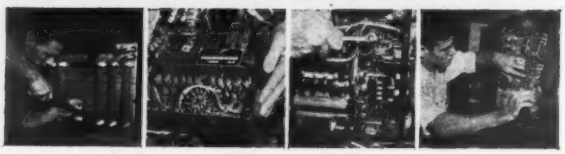

The Ward Leonard, Vitreous Enamel, Wire Wound Resistors shown are used on maintenance and operation equipment at the Miami Clipper base of Pan American World Airways.

ARMY E NAVY

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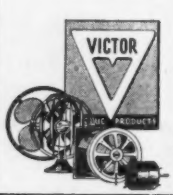
You've never seen it before, because it's for a house that won't be built until "V-Day". But when that day comes you can bet the truly American insistence on "something better" will be satisfied on many counts. Victor's business is ventilation, and our promise is that never again will a new home owner have to depend on draft-making windows to keep air sweet and fresh. At the flip of a switch, cooking fumes and stale air will be gone.

For the amusing but accurate picture of post-war ventilation, write for your free copy of the booklet, "You'll Do It 26 Thousand Times Today." Address Dept. IB-637.



Building for Uncle Sam today so that we can build for you tomorrow.

VICTOR ELECTRIC PRODUCTS, Inc.

2950 Robertson Rd. Cincinnati, Ohio

ment would consider integrity, efficiency, general experience, organization, financial condition, special aptitude, location of work, qualification of key men and need for business in determining the contractor. Sub-contractors would be chosen by the general contractor, subject to federal approval, on the same basis. Compensation would be a fixed fee determined by negotiation. Profit would not be allowed to exceed six percent on the negotiated price. The contractor's books would be audited before final payment, with any profit above six percent subject to repayment by the contractor.

The plan would cover all government construction contracts after passage of the bill.

COMING MEETINGS

International Association of Electrical Inspectors—Western Section, Chicago, Ill., LaSalle Hotel, September 13-15. Eastern Section, Providence, R. I., week of September 20. Southern Section, New Orleans, La., Roosevelt Hotel, September 27-29.

International Association of Electrical Leagues — Eighth Annual Conference, Netherland Plaza Hotel, Cincinnati, Ohio, Sept. 16-17.

National Electrical Contractors Ass'n—Annual Meeting, Hotel Drake, Chicago, Ill., Oct. 10-11.

LISTING CONSTRUCTION EQUIPMENT

Farmers have been entirely exempt from registering their used construction equipment by an amendment to Limitation Order L-196. The amended order also exempts from registration twenty-two small items of used construction equipment irrespective of ownership.

The Used Equipment program functions through the registration of idle used equipment with an attempt to place this equipment back into active service. The twenty-two items are now considered unimportant to the overall program. However, Schedule A of the amended order still contains a list of eighty-two items subject to registration.

INCOME TAX REMINDER

As a reminder to contractors who do not come under the wage and salary withholding provisions of the Current Tax Payment Act of 1943, it is required that the form Declaration of Estimated Income and Victory Tax be filed with the Collector of Internal Revenue by September 15. In addition, a payment is to be made on the total tax estimated for the year.

In this transition year from post-payment to current payment of tax obligation, the taxpayer can get on a current basis now by filing this Declaration form for the calendar year 1943. Thus on September 15, a payment of half the estimated tax is made minus combined quarterly payments already made on 1942 incomes

(which are credited on the 1943 return) and estimated Victory and withholding tax deductions for the year. The other half, shown by the declaration, still owing to the government for 1943, must be paid on or before December 15.

In case the taxpayer finds that he has miscalculated his estimated tax on the September 15th declaration, he has the privilege of filing an amended declaration on or before December 15.

Penalties are provided for failure to file declaration, pay required payment, or gross under-estimate of tax.

NEW OFFICERS NAMED AT BUFFALO ELECTRIC

The election of several new officers and directors was announced by President Karr Parker of the Buffalo Electric Co. Inc., Buffalo, N. Y. Charles J. Schwab, who has been apparatus manager and a director, was elected a vice-president.

W. L. Clark was elected a director and treasurer to succeed the late M. J. Diebolt. R. G. Harper succeeded Mr. Schwab as apparatus manager and was elected a director. He has been with the company two years and was formerly manager of the industrial division of the Buffalo District office of Westinghouse Electric and Manufacturing Company. F. I. Sigman, chief engineer, was chosen a director. He has been with the company 25 years.

MINOR CHANGES IN U-5 ORDER

The utilities order U-5 on communications has been amended with regard to certain definitions, and items on Schedule A.

"Wire communication equipment" shall include, but not by way of limitation, new and used wire telephone and telegraph communication equipment, parts and attachments thereto of the kinds listed in Schedule A."

An "authorized controlled material order" has been put on a par with "prefer-

SHOP SUPERINTENDENT, *Edward Krauth, Wm. C. Krauth Electric Co., Louisville, Ky., motor service shop, consults job ticket board listing all the work being repaired in the shop. A full board indicates the boys are being kept more than busy.*

Back on the Job with KLEIN'S

Since 1857

MANY linemen—electricians—and other Klein users are today engaged in the important job of maintaining communications on our war fronts all over the world.

In the service of men at the front, Klein equipment is winning even higher esteem than ever before. For today, practically all of Klein's production goes to the Army, Navy, and to war workers.

When the war is won and these men return to American industry, they will find Klein pliers and wrenches, climbers and grips, safety straps and belts ready to serve them on their peacetime jobs.

The name "Klein" will continue to mean the highest in quality then as it has "since 1857."

Back home, one contribution we can make to speed Victory is the conservation of tools and equipment. To help in this important job, Klein has prepared an illustrated pocket manual on the care and correct use of tools to assure their long life. A copy will be sent to anyone interested.

ASK YOUR SUPPLIER

Foreign Distributor: **International Standard Electric Corp., New York**

Mathias KLEIN & Sons
Established 1857 **Chicago, Ill., U.S.A.**
1900 BELMONT AVENUE CHICAGO

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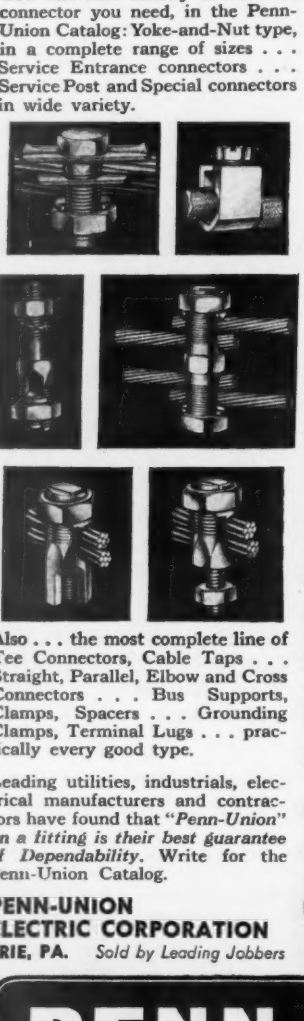
"All SIZES of SERVICE CONNECTORS—

from No. 10 to 1,000,000

and All TYPES"

You can find exactly the service connector you need, in the Penn-Union Catalog: Yoke-and-Nut type, in a complete range of sizes . . . Service Entrance connectors . . . Service Post and Special connectors in wide variety.



Also . . . the most complete line of Tee Connectors, Cable Taps . . . Straight, Parallel, Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Terminal Lugs . . . practically every good type.

Leading utilities, industrials, electrical manufacturers and contractors have found that *"Penn-Union" on a fitting is their best guarantee of Dependability*. Write for the Penn-Union Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

ence rating AA-5 or higher" used in the purchase or rental of parts, attachments or equipment.

Communications concerning this U-5 order are to be addressed: Communications Division, Office of War Utilities, War Production Board, Washington 25, D. C. Ref.: U-5.

Under Schedule A, the amendment has changed item 10 to read "wire inter-communicating sets not using electronic tubes as an essential part," and item 14 to read "time clocks, time switches, call boxes, signaling and selector equipment, and protective alarm devices used in wire telephone and telegraph systems."

SOLDER PRICE INCREASE

Sellers of solder and babbitt metal have been authorized by OPA to add to their prices the increased costs resulting from use of Treasury silver sold under the Green Act.

The new maximum price for any solder or babbitt metal containing silver is established as the highest price charged during March, 1942, plus 9.634 cents per fine troy ounce of foreign silver contained in the product, or plus 36.125 cents if Treasury or domestic silver is used.

These prices are authorized in amendment No. 15 to revised supplementary regulation No. 14 to the General Maximum Price Regulation.

Sellers who have no March, 1942 price for a particular solder or babbitt metal and whose competitors had none which could be used as a maximum price, may include the higher cost of the silver content in computing prices. Provisions for such pricing is made in Amendment 1 to Orders 325 and 443 of the General Maximum Price Regulation.

Treasury silver and newly mined domestic silver is priced at 71.11 cents while imported silver sells at 45 cents per fine troy ounce. Formerly, foreign silver was used almost exclusively in the manufacture of silver-bearing solder and babbitt metal.

FARMERS GET REPAIR RATING

Farmers may now use a certificate equivalent to an AA-5 rating for obtaining priority on repair shop facilities in repairing his farm equipment. This action is the result of an amendment to Priorities Regulation 19. The certificate is merely a signed statement to the effect that he is a farmer and that the supplies covered in his order are to be used in the operation of his farm.

PR 19 was originally designed to cover the sale of such new items as batteries, safety switches, welding rod, motor brushes, motors and starters under 1 hp., and BX or non-metallic sheath cable up to 75 feet in length. Many other items of farm equipment appear on this same list. The regulation does not cover second hand items. The amendment now makes such additions to the list as belts and pulleys including V-belt drives, weatherproof copper wire for circuits up to 75 feet in length, and wiring material and fixtures not including bare or insulated conductor wire.

If the farmer wants to use a certificate to buy more than $25 worth of any item on the list he must first obtain approval in writing from the County Farm Rationing Committee.

Suppliers can sell to farmers without certificate but are denied stock replacement. However, if sold on transmittal of this AA-5 equivalent certificate, he may make stock replacement of 75 cents at wholesale price on the $1.00 retail price of supplies sold against certificates. Suppliers do not have to replace stock item for item. The rating can be used in replacing stock with any equipment listed in the amended regulation.

MRO SUPPLIES

Governmental agencies and institutions using form WPB 837 (formerly PD 408) for maintenance, repair and operating supplies, may use ratings assigned for the third quarter of 1943 to the extent authorized on the form. Use of these ratings is permitted as an exception to the restrictions of PR 3 which prohibits use of ratings for certain items on List B for MRO supplies.

In addition, wooden factory and industrial equipment have been removed from list B by this Directive 1 and Amendment 1 to Priorities Regulation No. 3.

POWER TRUCKS RESTRICTED

Purchase orders for used industrial power trucks must be authorized by the War Production Board before they can be accepted in accordance with an amended Limitation Order L-112.

Authorizations of acceptance are made on Form WPB-1319 (formerly PD-556).

Industrial power trucks are self-propelled vehicles designed primarily for handling material on floors or paved surfaces in and around industrial plants, depots, docks, airports, etc.

Supplementary to L-112, the War Production Board also issued an amended

INSPECTOR OFFICERS of the Kentucky Chapter, IAEI are V. F. Knadler (left), Cincinnati, O., secy-treas.; and R. H. Scherzer, Louisville, chairman.

version of L-112-a naming additional manufacturers of industrial power trucks on the list of those who make models which are approved by the WPB and come within the provisions of L-112.

The amended Supplementary Limitation Order also places limitations on the specifications applied to fork-type models of industrial power trucks. The new specifications limit the height of the lift and the length of the forks on the trucks.

MINOR CHANGES IN L-41

Limitation Order L-41 which controls wartime civilian construction, has been amended by the War Production Board to reflect changes that have been made in other orders.

Since order U-6 places facilities owned by the telegraph companies under adequate priority control, it was considered unnecessary for telegraph installations to be under parallel control by L-41. Consequently, the amendment makes exception to these paralleling terms in L-41.

DEFECTIVE PARTS ORDERED DESTROYED

Parts for electronic equipment that have been found defective are to be disassembled and salvaged, or if not salvageable, they are to be destroyed. The purpose is to eliminate the possibility of these defective parts getting back into trade channels.

The order, which applies to producers and suppliers, is the result of an amendment to limitation order L-265. Previously the order had provided only for salvage, but now, if salvage is not practical, the defective parts must be destroyed. Whichever action is decided, it must be done within sixty days of receipt of defective parts.

NO ENDORSEMENT FOR HAND TOOLS

The special employer endorsement previously required for the purchase of hand tools by workers has now been eliminated by an amendment to General Preference Order E-5-a. Workers may obtain hand tools on orders under Direction 9 to CMP Regulation 5, or General Preference Order E-5-a, whichever applies.

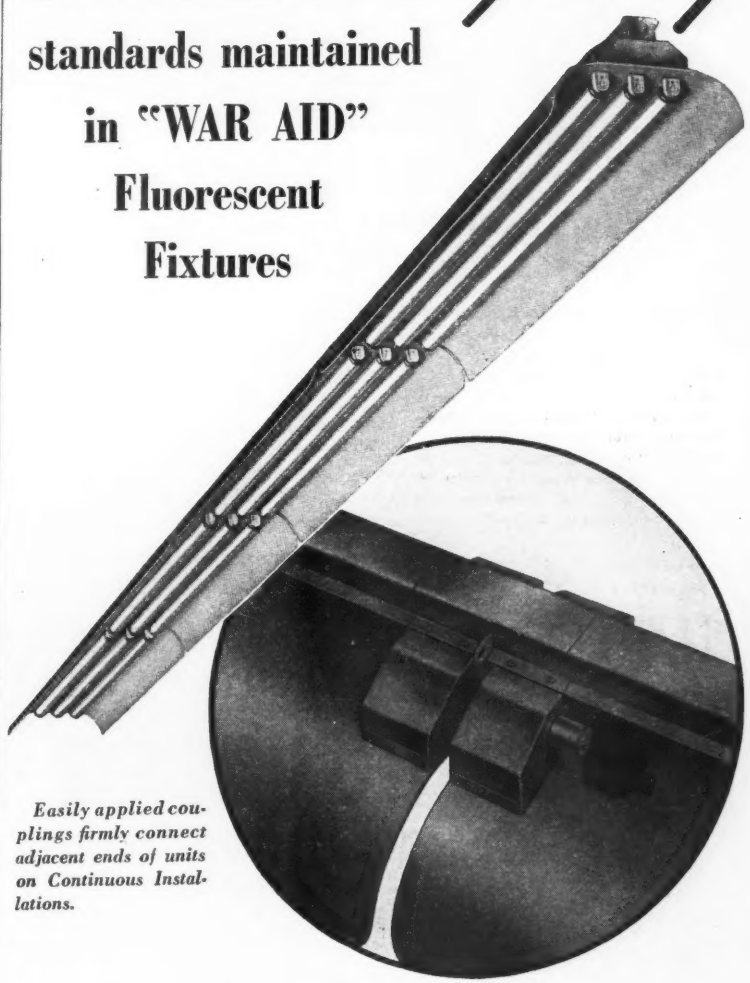
MORE STEEL FOR REFRIGERATION

Restrictions on the use of steel in specifically named parts of certain sizes of refrigerating equipment have been eased by WPB with the issuance of an amended Limitation Order L-126.

The changes brought about by the amendment are confined to Schedule II of

"Skilled" Lighting

standards maintained in "WAR AID" Fluorescent Fixtures



Easily applied couplings firmly connect adjacent ends of units on Continuous Installations.

Wheeler "War-Aid" Fluorescent fixtures are constructed for use with 2 or 3 40-watt lamps, and 2 100-watt lamps. Units are available for Individual or Continuous Installations.

Fixtures have a sturdy metal-conserving wiring channel, non-metallic reflector with chip-proof, washable surfaces. Minimum overall efficiency of 80% for 48" 2 lamp units, 76% for 3 lamp units, and 74% for 60" 2 lamp units.

Units are supplied with loops for chain suspension and with knockout for conduit mounting. In addition, Wheeler "C-Clamp" Sliding Hangers are available which permit fixtures to be mounted from rods, conduit, close to ceiling, or by messenger cable.

Whether you require fluorescent or incandescent illumination, Wheeler can supply Skilled Lighting for precision production. Write for catalogs of both types. Wheeler Reflector Company, 275 Congress Street, Boston 10, Mass. . . New York. Representatives in principal cities.

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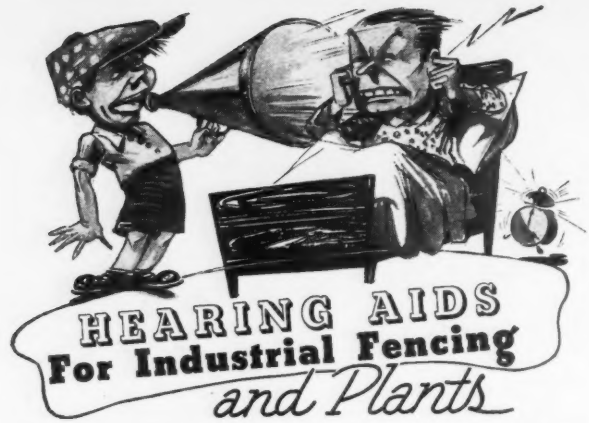
Lighting Equipment Specialists Since 1881



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For Industrial Fencing
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RELIABLE • ACCURATE • QUALITY

Our modern insulation testers make insulation testing easy . . . Entirely self-contained. Steady test potential of 500 volts DC, available at the touch of a switch. Direct reading in insulation resistance.

VARIOUS NEW MODELS AND RANGES
— WRITE FOR BULLETINS

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The Stone You Can Bend and Twist

Flex-Stone

DRESSES AND CLEANS ALL ELECTRICAL PARTS AND CONTACTS

What a job FLEXSTONE does! Cuts like an abrasive stone—but you can bend, twist it. *Won't break!* Thin, non-brittle. Sharpest abrasives are pressed into flexible core. Easily fits tight places. Smooths hardest contact points in relays, cutouts — cleans small commutators, switches, etc. Non-conductor — no short circuit. Rimac FLEXSTONE speeds electrical service. Send for *free sample!*

RINCK-McILWAINE, Inc., 16 Hudson St., New York, N. Y.

the order. The most important provisions:

Permit manufacture of water cooled condensing units of two horsepower or less designed to operate at a refrigerant suction temperature below minus 40 degrees Fahrenheit.

Permit the manufacture of three horsepower air-cooled condensing units, three horsepower water and air-cooled models and special models operating below 25 degrees Fahrenheit.

Permit the use of carbon steel for condensing unit bases to the extent of 30 pounds per horsepower and an unlimited amount of cast iron.

Remove restrictions on use of steel for fan shrouds.

AUTHORIZATION FOR RESISTANCE WELDERS

The General Limitation Order L-298 which covers resistance welding equipment has been amended to the following extent.

"On and after July 27, 1943, no manufacturer or dealer shall accept an order for, or deliver any new resistance welding equipment unless the order or delivery is specifically authorized by the War Production Board on Form WPB-2752. Application for an authorization, and for a preference rating if none has been previously assigned, is to be made by the purchaser by filing Form WPB-2752, in duplicate, with the War Production Board as explained in the instructions which accompany the form. The delivery restrictions of this paragraph do not apply to orders received prior to July 27, 1943."

CARBON BRUSH SIMPLIFICATION

Progress has been reported on the carbon brush simplification project by Dr. E. W. Ely of the National Bureau of Standards. He said that a committee, representing the motor manufacturers, the brush manufacturers, and brush users is being formed to assist in collecting data.

Members of the Committee asked Dr. Ely, as a representative of the Bureau of Standards, to note the progress in simplification that had been made by various technical groups in the electrical industry as well as that made by their own Advisory Committee. They recommended that the Bureau correlate these various efforts with its own.

COPPER FOR RADIOS

The use of copper in the production of radio sets and parts for private use, when the manufacture of such products is permitted under Limitation Order L-265, has been approved by WPB through an amendment to Conservation Order M-9-c. The action brings the two orders into agreement, as such use of the metal previously had been forbidden, even for the production of repair parts.

FACILITIES PROGRAM 80 PERCENT COMPLETE

The nation's gigantic government-financed war facilities program was more than four-fifths completed at the year's midpoint according to a report by Chairman Donald M. Nelson of WPB.

At the end of June, the completion of $12,038,000,000 out of a current $14,582,000,000 Government-financed war facilities program had been accomplished, Mr. Nelson said. That compares with 61 percent at the beginning of the year and only 34 percent a year ago.

The midyear mark saw the greatest accomplishment in the construction of plants to produce finished munitions such as guns, combat vehicles, aircraft, ships and ammunition. Facilities for production of ammunition and explosives were 95 percent completed.

This remarkable record, Mr. Nelson declared, means that the arsenal which America is building to defeat the Axis is rapidly nearing completion, and as facilities construction moves along a planned decline, more and more of the nation's resources can be thrown into the direct production of munitions.

The construction and equipment of plants to produce raw materials, such as synthetic rubber and steel, was fast catching up after earlier tendencies to lag. The extent of the advance which has been gained in this category this year is illustrated by the synthetic rubber program. Only 3 percent finished a year ago, the synthetic rubber facilities program was 15 percent in place at the beginning of 1943, and had risen to 61 percent by the end of June.

It is only since the beginning of this year that raw materials facilities passed the half-way mark, Mr. Nelson pointed out. For example, while only 15 percent of the federally financed synthetic rubber program was in place on January 1, construction and equipment deliveries moved rapidly ahead to the favorable position they occupied at the end of June after receiving preferential treatment for components.

The largest percentage gain of the first half was registered for plants to produce 100-octane gasoline. At the beginning of the year, less than than 1 percent of the Government-financed program was in place, but by July 1 the program was about 39 percent complete. High-octane gasoline plants have been granted high preference ratings, and steady increases in the program may be expected over the remaining months of the year. Even greater progress has been made in the privately financed high-octane program where, by July 1, around 63 percent of the expansion had been completed.

An encouraging picture is reflected in the iron and steel program, which is now more than 75 percent in place. Seven of the plants that are the furthest advanced are being rushed to completion this year, and these alone will make up about one-third of the entire program.

In the field of chemistry, the rate of expansion has been extremely favorable. Only 31 percent complete a year ago, the chemical program had risen to 66 percent

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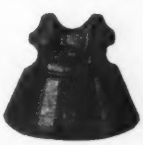

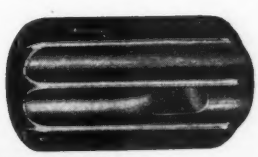
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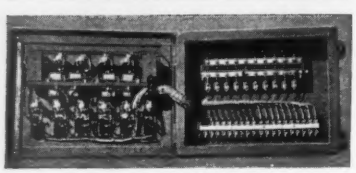

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at the beginning of 1943 and is more than 90 percent completed today.

An analysis of the Government's war facilities program this year clearly indicates that the end of the munitions facilities program is the beginning of the end of the raw materials program. Of the facilities completed in 1942, the largest proportion—70 percent—went into ordnance, aircraft, and shipway facilities, while only 21 percent went into raw materials.

ADDENDA

Unintentionally omitted from the list of contractors mentioned in connection with the electrical work on the New York City aluminum plant in "Power for Aluminum" of the July issue were:

Wm. T. Dippel, Inc.
Gibbs and Hill, Inc.

PRICING OF LAMPS

Lamp manufacturers, jobbers and retailers alike are cautioned by the Office of Price Administration against violations of pricing and sales methods, currently reported from many parts of the country.

Violations reported include such practices as the following:

(1) Manufacturers exacting exorbitant price increases based on merely minor changes of design. In many instances certain firms have slightly altered insignificant features of old items in their lamp lines—generally at no increase in cost of manufacture—and used that as an excuse for increasing, possibly even doubling, the original selling price of the lamp. In this regard OPA says that where a new lamp showing minor design changes has a material cost substantially the same as the original lamp, the new one must be sold at a price no higher than the maximum price of the original item.

(2) Disregard by manufacturers of price differentials to different classes of purchasers. OPA re-emphasizes that if, for instance, a manufacturer in March, 1942, sold to large department stores at low prices and to small gift shops at higher prices, his prices to the large stores must be no higher than in March, 1942. If a manufacturer has introduced a new item into his line, his ceiling price to the large buyer for that item also must be calculated by applying the same proportionate discount to the large buyer as was customary in March, 1942. Where a manufacturer normally sold to a jobber at a discount below the price he ordinarily sold to a retailer, this same discount must be applied on all sales currently made to any jobber.

(3) Sales by jobbers who never previously have sold lamps, at prices which have not been properly established in accordance with OPA regulations. OPA has learned that many manufacturers now are selling lamps to jobbers who heretofore did not handle lamps, as well as to their own salesmen. Instead of establishing their maximum prices properly, in accordance with the General Maximum Price Regulation,

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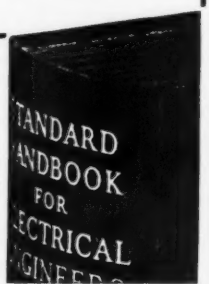

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these new middlemen are reported as using higher mark-ups than the industry customarily enjoyed, and in some instances as deliberately pyramiding even these excessive prices by frequently selling to other jobbers, who in turn repeat the same illegal procedure.

Manufacturers are reminded by OPA that sales of portable lamps and shades are under the jurisdiction of Maximum Price Regulation 188 (Manufacturers' Maximum Prices for Specified Building Materials and Consumers' Goods Other than Apparel). This Regulation requires that any new number introduced into a manufacturer's line since August 1, 1942, must be reported to OPA at Washington prior to being offered for sale, unless it may be priced in accordance with Section 1499.155.

Jobbers, wholesalers and retailers of lamps, OPA emphasizes, must establish their maximum prices in accordance with the General Maximum Price Regulation, which similarly sets a March, 1942, base pricing period.

Both the General Maximum Price Regulation and Maximum Price Regulation 188 expressly forbid any person in the course of trade or business to buy regulated commodities at a price higher than the ceiling permitted by the applicable regulation. This stipulation makes such buyers as well as the seller guilty in case of violations.

Disregard of the foregoing rules renders the offender liable to serious penalties, civil enforcement action, and a suit for treble damages, as provided for by the Emergency Price Control Act of 1942.

NEW LIBERTY SHIP CONTRACTS

Contracts for the construction of 223 Liberty ships to be built by Gulf and East Coast shipyards have been announced by the United States Maritime Commission.

The New England Shipbuilding Corporation of South Portland, Maine, was awarded a contract to build 115 ships. A contract calling for the construction of 108 vessels was awarded to the Houston Shipbuilding Corporation of Houston, Texas.

Award of contracts is in line with the Commission's emergency shipping program and will round out the Liberty ship schedule for these two yards.

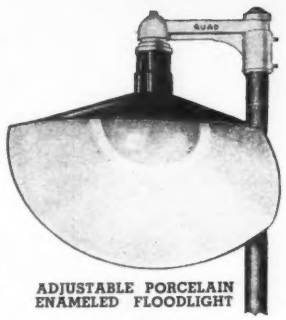
CIVILIAN REQUIREMENTS REPORT ISSUED

The Office of Civilian Requirements has presented to the War Production Board a tentative program for the production of essential consumer goods necessary for the efficient functioning of the civilian economy according to WPB Vice Chairman Arthur D. Whiteside.

The fact that certain essential articles will be produced does not mean that OCR intends, because of the critical materials required, to reopen substantial manufacture of many items formerly produced for civilians, Mr. Whiteside said in summarizing the first report of his office to WPB.

QUAD

LIGHTING UNITS



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OCR recommendations now will go before the WPB Requirements Committee which will go over them, in conjunction with the general war program, to decide what materials can be spared.

"By wise use of about the same quantities of materials that have been made available for civilian production during recent months," Mr. Whiteside said, "essential civilian services and the production of essential civilian goods can be maintained. The needs of the war at present permit no other course.

"The civilians of this country realize that a continuing drop in the quantities of goods which formerly made up their standard of living must be expected during a total war and that every possible resource must be directed toward military victory. Our objective is to provide the essentials that will permit the civilian population to maintain itself in a sound and vigorous condition in order to produce at maximum efficiency for war."

To carry out that program, the OCR has adopted these policies, which have been approved by the Civilian Requirements Policy Committee:

1. "We must insure that all minimum essential civilian requirements are met and in addition that all national resources above that level, which cannot be employed effectively to meet our military and foreign policy needs are utilized to supply civilians. We do not advocate forcing the civilian population down to bare subsistence levels in the present military situation.

2. "Supplies for civilians will be considered to be at the minimum essential level for any product or services when further reduction would impair civilian health, morale or working efficiency or the national economic structure beyond what is justified by the prospective gain to the war through release of resources.

3. "Adequate repair parts, replacement parts and labor must be made available to maintain existing essential equipment in civilian hands in operating conditions.

4. "The distributive and service trades must be maintained to the extent necessary to make essential goods and services available to civilians when and where needed.

5. "The need of such groups as new families, infants and children, workers with special requirements and rapidly-growing communities will receive particular consideration.

6. "Damage to the basic economic and social structure will be avoided to the extent consistent to the prosecution of the war and the satisfaction of essential civilian requirements. Small business concerns will be utilized to the fullest extent practicable in the production and distribution of civilian goods and services.

7. "Every effort will be made to economize the use of resources and to conserve the goods now in civilian hands.

8. "Every sacrifice that the civilian population is called upon to make will be in furtherance of our war effort and no unnecessary sacrifies will be called for.

9. "Public information will be furnished promptly to enable the civilian population to understand the reasons for government decisions limiting the supply of civilian goods and services."

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"The Civilian Requirements Policy Committee," said Mr. Whiteside, "unifies the agencies which as a whole look after civilian needs and are responsible for the maintenance of a sound and vital civilian population. The Committee correlates the policies of the several government agencies concerned with the supply of essential goods and services for civilians in order that civilians may make their maximum contribution to the war."

The Committee, of which WPB Chairman Donald M. Nelson, is chairman and Mr. Whiteside, vice chairman, has as members Secretary of Agriculture Claude R. Wickard, War Manpower Commission Chairman Paul V. McNutt, Price Administrator Prentiss Brown, Petroleum Administrator for War Harold L. Ickes, and Office of Defense Transportation Chairman Joseph B. Eastman. In addition, War Food Administrator Marvin Jones, National Housing Administrator John B. Blandford, Jr., and Smaller War Plants Corporation Chairman Brigadier General Robert V. Johnson are invited to sit in with the Committee.

SEEKS SERVICE SHOPS

The Crocker-Wheeler Electric Manufacturing Company is actively seeking additional service shops in outlying industrial areas to act as repair headquarters for their motors and generators.

An estimated 20,000,000 horsepower of this company's motors and generators is in operation in U.S.A. A program is under way to line up local repair agencies to service this equipment in every industrial center in the United States.

FARMSTEAD WIRING UNDER FOOD ADMINISTRATION

The War Food Administration headed by Judge Marvin Jones has taken over the distribution of copper wire for farm purposes.

County War Boards issue "Copper Wire Allotment Certificates" to farmers who can place their orders with dealers, who in turn may use the certificate as a CMP allotment. Wire for dwellings and small purchases are still obtained under PR-19.

SUBCONTRACTS TO LESS CRITICAL AREAS

Because of the increasing shortage of manpower in certain critical areas, approximately one thousand prime contractors who have backlogs of orders totaling $5,000,000 or more each have been requested to place future subcontracts for fabrication of products in the less critical labor supply areas.

The request to observe this policy, which was called "vital to the war effort," was contained in copies of a letter signed by Chairman Nelson of the War Production Board, Chairman Land of the Maritime Commission, Under Secretary of War Patterson, Under Secretary of Navy Forrestal

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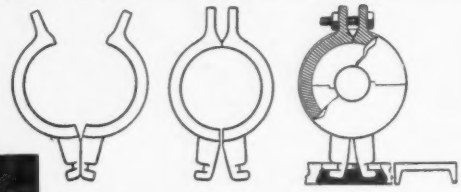

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H. B. SHERMAN MFG. CO. BATTLE CREEK, MICH.

Sherman SOLDERLESS LUGS

and Clifton Mack, Director of the Procurement Division of the Treasury Department.

This letter, in effect, urged prime contractors to follow the same policy in placing subcontracts which the Federal Government observes in placing prime contracts.

PRIORITIES

MATERIALS FOR NEW CONSTRUCTION

Interpretation 9 to CMP Regulation No. 5 clarifies the following three cases with regard to the beginning of construction work.

(a) Order L-41 requires War Production Board authorization before beginning any construction work except in those cases where the order expressly states that authorization is not necessary.

(b) CMP Regulation No. 5 (3175.5) may not be used to get materials or products for any construction work of the type which requires authorization under Order L-41, unless the authorization specifically says that CMP Regulation No. 5 may be used.

(c) In those cases where specific War Production Board authorization is not required before beginning construction, and where the materials needed for the construction cost no more than $500, CMP regulation No. 5 may be used to buy materials and products needed for the construction.

EMPLOYEES MAY BUY SAFETY EQUIPMENT

Employers preference ratings may now be used by the employee to purchase safety equipment. Previously CMP Regulation No. 5 permitted only the employer to buy safety equipment for his employees. The equipment remained the property of the employer and was checked out to the employee when needed. Nor could the equipment be resold to the employee.

This order still stands as is, but a provision has been added permitting employees to use their employers rating in the same manner as hand tools are now purchased under Direction 9, CMP Regulation No. 5.

Since the employee is not in business, he heretofore has not been permitted to use a preference rating. Direction 11 to CMP Regulation No. 5 now provides him with a rating.

The employee of any person producing any product or conducting any business listed on Schedule I or Schedule II of CMP Regulation No. 5 may use the preference rating assigned by the regulation to his employer. The rating may be used only to purchase safety equipment which he requires for use exclusively in his employer's business and which his employer requires him to furnish.

The rating will be valid only if the employee gives the seller of the safety equipment the certificate similar to that

provided for in Direction 9 to CMP Regulation No. 5 for the purchase of hand tools. The certificate must be signed by both the employer and employee.

The term "safety equipment" as used in this direction means the following items when they are specifically designed and used to furnish protection against specific occupational hazards (other than weather):

1. Asbestos clothing.
2. Gauntlet type welders' leather gloves and mittens, and electricians leather protector or cover gloves.
3. Metal mesh gloves, aprons and sleeves.
4. Other safety leather gloves or mittens, but only if steel stitched or steel reinforced.
5. Plastic and fiber safety helmets.
6. Safety clothing impregnated or coated for the purpose of making the same resistant against fire, acids, other chemicals or abrasives.
7. Safety industrial leather clothing other than shoes, gloves or mittens.
8. Safety industrial rubber gloves and hoods and linemens' rubber gloves and sleeves.
9. Gas masks and canisters.
10. Respirators.
11. Face and eye shields.
12. Welding helmets and shields.
13. Goggles.
14. Foot and shin guards (not including safety shoes).
15. Safety belts and harnesses.
16. Protective creams.

The following example is given to show how an employee may use his employer's rating to purchase safety equipment. Suppose that a shipyard requires certain employees to have a welding shield. The employee himself is not entitled to use a preference rating assigned by the regulation because he is not in business. The employee finds that he cannot buy the welding shield without a preference rating. Shipyards are in Schedule I of CMP Regulation No. 5 and consequently may use preference rating AA-1. Under this direction the employer may fill out the certification, putting down the preference rating "AA-1" and listing the item "welding shield." The proper official of the employer signs the certificate and gives it to the employee. The employee then signs the certificate and gives it to the seller of the welding shield.

REJECTION OF RATED ORDERS

Circumstances under which a seller may reject rated purchase orders which do not meet his regularly established terms of sale have been clarified by the War Production Board. The interpretation will permit sellers to follow normal business practice, under certain conditions.

Rated orders may be rejected for the following reasons:

1. Where a rated order calls for quantities which are less than the minimum which a person regularly sells. For example, a manufacturer who has been selling only in carload lots may reject a rated order for less than a carload lot.

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INDUSTRIAL MAINTENANCE

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What is more, these quality devices are handled by a General Electric distributor right in your own territory. You are sure to find G-E Wiring Devices suitable for your particular needs conveniently.

See the G-E Merchandise Distributor near you for further information or write to Section D931-104, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn., for G-E maintenance wiring device broadside.

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*(Records on file.)

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2. Where a person regularly sells only to certain types of trade purchasers, such as wholesalers, jobbers, or retailers, he may reject orders from other types of purchasers, but only if the merchandise can be obtained in the required quantity through regular trade channels.

3. Where a manufacturer or wholesaler has an exclusive distributor, either for all sales or for a particular territory, he may reject rated orders from other purchasers, provided the exclusive distributor is in a position to fill the orders promptly.

These provisions, which are contained in Interpretation 3 to Priorities Regulation, clarify exceptions to the rule that a vendor must sell his product to any person who presents him with a rated order.

The three cases fall within the scope of the general exception permitting rejection of rated orders "if the person seeking to place such order is unwilling or unable to meet regularly established prices and terms of sale or payment, but there shall be no discrimination against such orders in establishing such prices or terms."

P-100 COMPLETELY REVOKED

Preference Rating Order P-100, dealing with maintenance, repair and operating supplies, has been completely revoked.

The order previously was revoked as of April 2, except as to producers in Canada, to whom a serially numbered copy had been issued. Canadian companies are now eligible to apply through the Department of Munitions and Supply, Ottawa, Canada, to the War Production Board for authorization to use the procedures established under CMP Regulation No. 5 to obtain their necessary maintenance, repair and operating supplies.

FREON FOR ESSENTIAL USERS

Operators of essential refrigerating and air conditioning systems will find chlorinated hydro-carbon refrigerants (Freon) increasingly available according to an announcement made by WPB.

The amount which may be allotted to the restricted list of essential users under General Preference Order M-28 is only 22 percent less than the amount distributed to all users of the refrigerant last year.

The prohibition of the use of chlorinated hydro-carbon refrigerants for comfort cooling systems continues in effect.

MUST MAINTAIN AIR CONDITIONING UNITS

The shortage of Freon refrigerant for air-conditioning purposes makes its imperative that theaters, office buildings, hotels, restaurants, and other service institutions equipped with "comfort cooling systems" take immediate steps to conserve their present supply of the refrigerant.

A recent amendment to Order M-28

110 VOLTS A. C.
ANYTIME ANYWHERE

with KATOLIGHT GENERATORS supplying electricity, same as you obtain from power lines, right out in the field which permits our fighting forces to be equipped with the most modern electrical appliances.

10 K.W., revolving armature, separately excited A.C. generator.

Good deliveries on A.C. generators, 350 watts through 25 K.W. designed for direct attachment to standard engine bell housings or independent generators. Available in all standard voltages, single and three phase, 1200 and 1800 r.p.m. Good voltage regulation.

Kato's entire production at present must be confined to high priority orders.

Also manufacturers of Rotary Converters, High frequency generators, Frequency Changers and Motor Generator Sets.

Write for new Generator Circular

KATOLIGHT COMPANY
101 Elm St., Mankato, Minn.

Safe-T-Glow
HIGH TENSION DETECTOR

SAFETY RULES call for that EXTRA precaution and additional RE-CHECK which SAFE-T-GLOW provides. Detects accidental tie-ins, crossovers, leakages and induced voltages . . . prevents serious injury and loss of life. SAFE-T-GLOW consists of a sensitive Neon tube, amplified by mirror reflector.

Model A for circuits 2,000 to 35,000 volts. Model B for circuits from 35,000 to 220,000 volts.

TEST-O-LITE
Tests Everything Electrical from 100 to 550 Volts

Equipped with Neon light which tells instantly where trouble lies in circuits, fuses, cut-outs, motors, etc. Indicates hot or grounded wires. Tells AC from DC. SAVES PRECIOUS TIME. Has PATENTED safety features. Vest pocket size with clip. Lifetime guarantee. List Price $1.50 at leading jobbers.

L. S. BRACH Mfg. Corp.
55-63 Dickerson St. Newark, N. J.

(Chlorinated Hydrocarbon Refrigerants) has barred the delivery of Freon refrigerant to any comfort cooling system. The action was taken to conserve the chemical for essential war industries and for preservation of perishable foods.

This does not mean imminent shut-down of currently operating cooling systems. With proper care and maintenance of existing equipment, the refrigerant can be used for several years without deterioration.

However, to assure continued operation of the equipment, a complete check and necessary repairs should be made without further delay as a precaution against leakage or loss of the refrigerant. Once present charges of the refrigerant are lost, there will be no possibility of replacing them under present restrictions. This in effect will force abandonment of the air-conditioning system until Freon is once more available.

Where emergency repairs are necessary, repair and maintenance parts may be obtained through ratings assigned under Controlled Materials Plan Regulation No. 5.

The ban on refrigerants applies only to Freon and does not affect deliveries of carbon dioxide or any other type of refrigerant used in comfort cooling systems.

PD-1X FORM SUPERSEDED

Form PD-1X—used by distributors in obtaining priority assistance for replacing inventories—has been superseded by a new, simplified application titled WPB-547.

Intended primarily to reduce the amount of paper work involved in filling out the old form, the new application has been greatly simplified in design and appearance and is expected to expedite the filing and handling of requests for ratings to replenish distributors' stocks. Other improvements are designed to cut down substantially the clerical work in processing the applications.

Copies of the new form are available in WPB field offices.

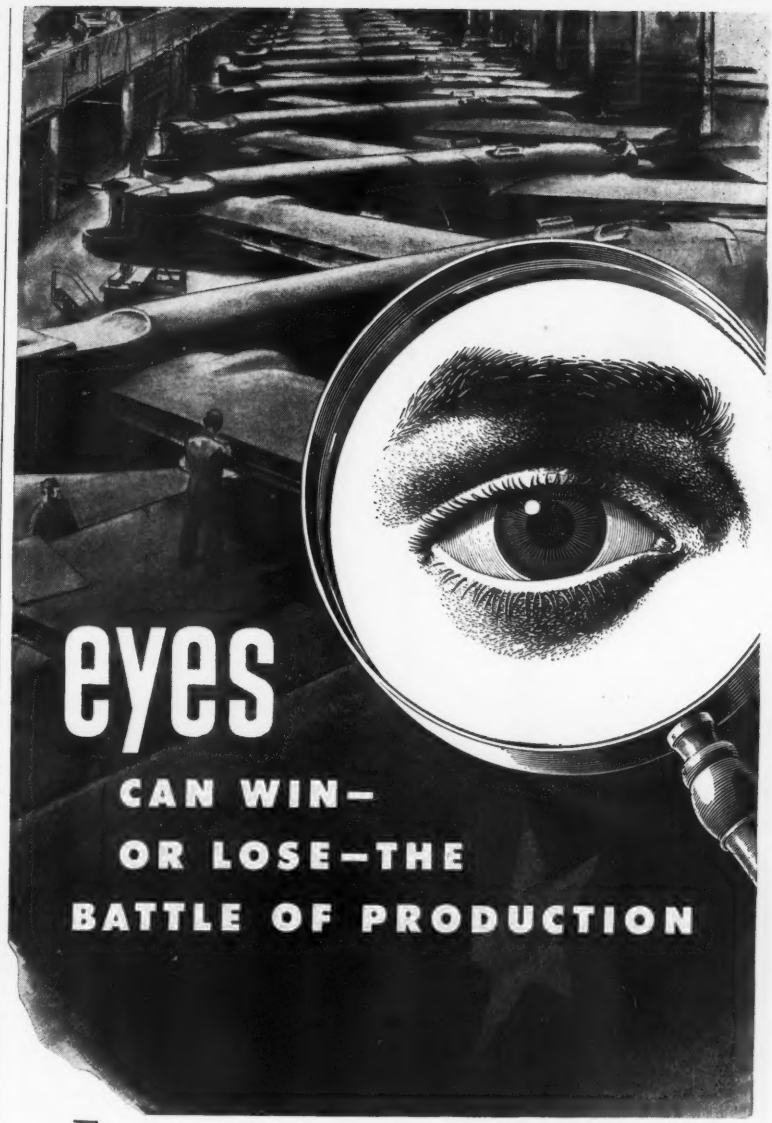
WPB officials urged distributors to take every precaution against omission of any of the information called for by the applications. Forms which are improperly filled out or which fail to include all the necessary facts will be returned.

Major changes in the revised form are summarized below:

1. Size of the application has been altered to permit its insertion into any standard typewriter carriage without folding and to permit answering all questions without removing the form from the carriage. Also, the form folds into a standard 8½ by 11-in. letter size, facilitating mailing or filing.

2. More space is provided in the upper right-hand corner for the applicant's name and address. When cut out, this block becomes a control card bearing the WPB case number, the date of filing of the application, and the name and address of the applicant.

3. Spaces to be filled out are numbered, with corresponding numbers listed on the instructions.



Eyes are *that* important! For they control almost 90 per cent of all human motions.

Small wonder that busy war plants lay so much emphasis on proper illumination—to help the eyes and hands work faster, more accurately—to increase production for Victory.

Goodrich illuminating engineers are busy solving lighting problems for industrial management. They are ready to help you, *now,* while there is still time. *Goodrich industrial equipment is sold only through electrical wholesalers.*

RLM

GOODRICH
ELECTRIC COMPANY
OFFICES IN ALL PRINCIPAL CITIES
GENERAL OFFICES AND FACTORY: 4602 BELLE PLAINE AVENUE, CHICAGO, ILL.

UMI

PARTS

For

MOTORS • FANS

CONTROLLERS

Authorized Distributors of parts for General Electric Co. — Robbins & Myers — Leland — Marathon — Master — Delco — Emerson — Hamilton Beach — Hunter — Century — Wagner — Ilg — Chicago Electric — Waring — Proctor — Thor — Peerless — Vaculator — Westinghouse — Allen Bradley — Cutler Hammer.

WINDING MATERIALS & REPAIR SHOP SUPPLIES

Write for Catalogue

READING ELECTRIC COMPANY, INC.
200 William St. New York, N. Y.

4. After indicating the general type of supplies covered by the application, the distributor is now required to report his current sales and inventory figure for his entire business. The option of showing figures only for a department or a class of materials has been removed in order that a picture of the entire operations of the applicant may be secured.

5. Date and case numbers of the applicant's most recent WPB-547 or PD-1X applications covering any of the items appearing on the new application must be included. Also, the form must show whether or not ratings were assigned or whether a re-application is being submitted. Purpose of this is to prevent any abuse of the application form and to provide a check against persistent resubmission of an application which has been once rejected.

6. Previously, applicants were required to show their inventories as of December 31, 1941. They are now allowed to select any month in the period between December 31, 1941 and the month six months previous to the date of the application. Also, book or physical inventory may now be used in computing this figure.

7. Space is now included in the application for inserting any added information other than that called for by the application, obviating the need of sending a separate letter.

8. All references to Order L-63 are removed from the form. Instead, certification must be made to the effect that receipt of the material included in the application will not increase inventory beyond the limits of any WPB order or regulation or beyond a practicable working level.

UTILITY EXTENSIONS FOR FARM ELECTRIFICATION

A policy to govern farm electrification extensions in excess of 5,000 feet has been announced by the Office of War Utilities. These extensions have been held up in recent months because of the amounts of materials involved.

Since January 1 shorter extensions have been held up in recent months because of the amounts of materials involved.

Since January 1 shorter extensions have been approved almost automatically for applicants who qualify before their USDA County War Boards under the terms of Order U-1-c. While the same general terms will apply to the longer extensions, each application will be considered individually by the Office of War Utilities.

While no greater amounts of material for farm extensions are available than has been the case heretofore, studies have revealed that the increase in food production is proportionately great enough in some instances to warrant longer lines.

Applications for extensions in excess of 5,000 feet must meet these requirements:

1. Electricity will increase food production and save farm labor.

2. The requisite number of animal units as defined in Order U-1-c must be present, or reasonably obtainable, on the farms to be served. (U-1-c permits 100 feet of wire for each animal unit. An animal unit consists of either one milk cow, 10 beef cattle, 30 breeding ewes, three

To Help You Plan and Estimate Wiring Installations

AUSTIN

OFFERS

OUTLET BOXES
SWITCH BOXES
BAR HANGERS
LINE-O-LETS
BOX CONNECTORS
HEAVY WALL CONDUIT FITTINGS
THIN WALL CONDUIT FITTINGS
BUSHINGS AND LOCKNUTS
CONDUIT AND CABLE STRAPS
R E A FITTINGS
TOOLS
LUGS
NIPPLES
WIRES AND CABLES
ARMORED CABLE
THIN WALL CONDUIT
HEAVY WALL CONDUIT

These are just some of the items shown in our new 1942 144-page catalog. It is full of useful information and contains hundreds of illustrations that will be most helpful to you. Send for your copy today —ask for Catalog No. CF17.

THE M. B. AUSTIN COMPANY
110 S. DESPLAINES ST. CHICAGO

K&H Solderless Terminal LUGS — **A SIZE and TYPE for every need!** — **K&H Solderless CONNECTORS**

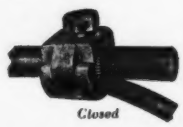
TWO-CONDUCTOR BRANCH TAP CONNECTORS

Cat. Nos. 1515 to 1531—Machined to receive definite size wires for the main while taps are for two conductors equal or varying size. Supplied in double branch, twin or multiple conductors. Wire sizes: — Main, 8 to 2,000,000CM; Tap, 8 to 650,000CM.

SWIVEL CLAMP CONNECTORS

No Removable Parts

Open



Closed

Cat. Nos. C6 to C10—In application, screw is withdrawn to certain point where bottom portion of connector will swivel around so that top portion may be hooked over main wire; swung back into position they are ready for clamping. Maximum wire sizes: C6 two No. 4—C8 two No. 1—C10 two No. 2/0.

***Write for* BULLETIN 16-D *and* 19-A**

KRUEGER & HUDEPOHL
123-8 VINE ST. CINCINNATI, OHIO

brood sows, 75 laying hens or 40 turkeys.

3. Applications which involve a number of extensions, the farms on each extension must have the requisite animal units to support that particular extension. No extension may be built to a farm having less than five animal units and non-farm residences, schools and churches may not be included.

4. Electrically-operated farm equipment must be available, or obtainable.

All such extensions, like the shorter ones, must be built with steel conductor wire instead of copper. Copperweld steel conductor manufactured from material rejected by the armed services may be used to the extent it is available. All other copperweld conductor used must come from excess stocks.

The policy will apply to both private and publicly-owned lines.

MANUFACTURERS NEWS

WESTINGHOUSE PROMOTIONS

Two district managers have been elected vice-presidents of the Westinghouse Electric and Manufacturing Company. They are Fred T. Whiting, manager of the Company's Northwestern District, with headquarters in Chicago; and Charles A. Dostal, Pacific Coast District manager, with headquarters in San Francisco. The duties and headquarters of both men are unchanged.

STUART

Ralph C. Stuart has been appointed manager of the Lamp Division of Westinghouse, with headquarters in Bloomfield, N. J. Mr. Stuart will have charge of all activities of the Lamp Division, including sales, illumination engineering, district office activities of the Lamp Division, as well as manufacturing and engineering in the Division's five plants in New Jersey and West Virginia.

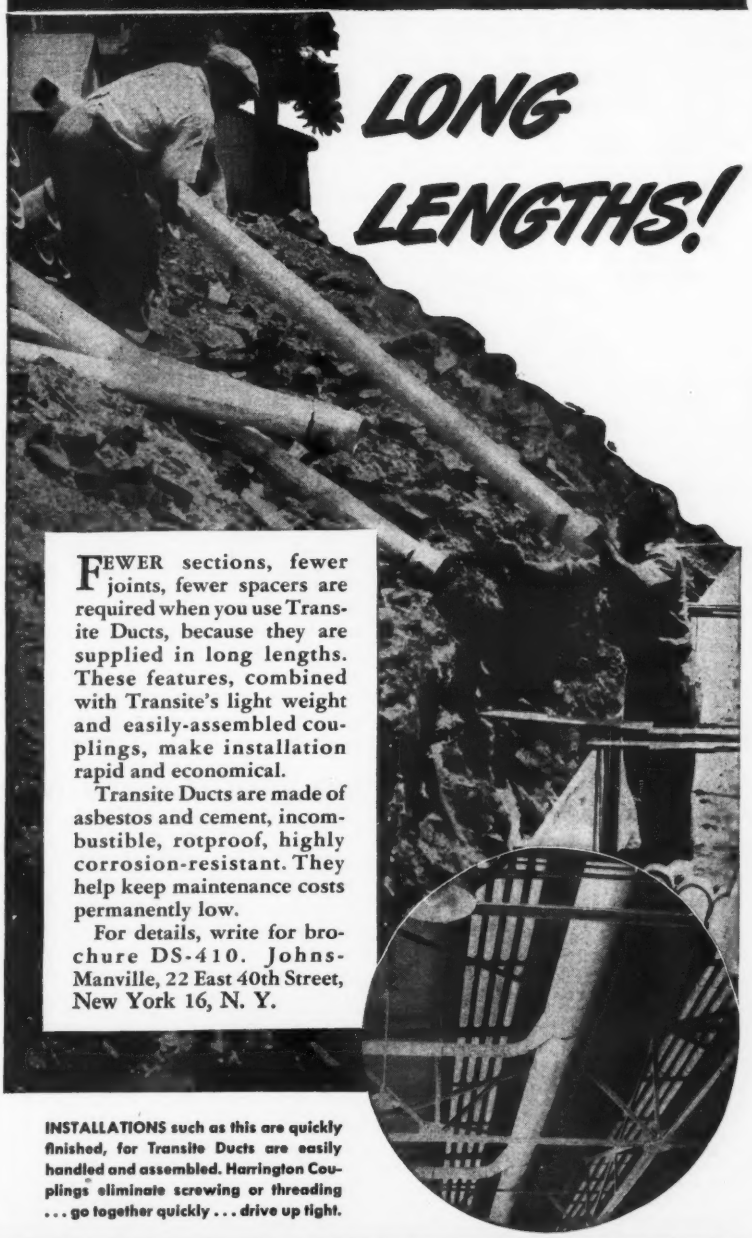
G-E APPOINTMENTS

Ralph J. Cordiner has been appointed assistant to the president of the General Electric Company. Mr. Cordiner, who resigned in June as vice chairman of the War Production Board, was formerly president of Schick, Inc., of Stamford, Conn., prior to which he was manager of the appliance and merchandise department of G-E. His office will be at 570 Lexington Avenue, New York.

CORDINER

W. B. Gillen has been named manager

TIME-SAVING FEATURES OF J-M TRANSITE DUCTS--NO. 3



FEWER sections, fewer joints, fewer spacers are required when you use Transite Ducts, because they are supplied in long lengths. These features, combined with Transite's light weight and easily-assembled couplings, make installation rapid and economical.

Transite Ducts are made of asbestos and cement, incombustible, rotproof, highly corrosion-resistant. They help keep maintenance costs permanently low.

For details, write for brochure DS-410. Johns-Manville, 22 East 40th Street, New York 16, N. Y.

INSTALLATIONS such as this are quickly finished, for Transite Ducts are easily handled and assembled. Harrington Couplings eliminate screwing or threading . . . go together quickly . . . drive up tight.

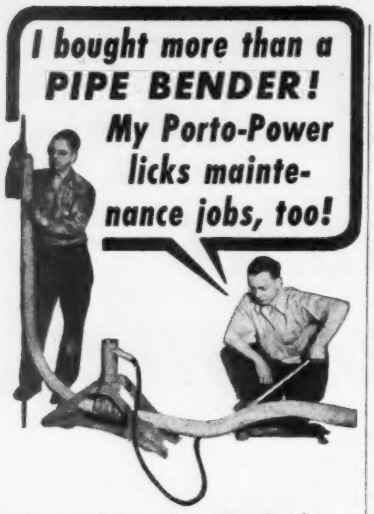
JM Johns-Manville

TRANSITE DUCTS

TRANSITE CONDUIT . . . for exposed work and for installation underground without concrete encasement.

TRANSITE KORDUCT . . . for installation in concrete. Thinner-walled, lower-priced, otherwise identical with Transite Conduit.

UMI



Blackhawk Porto-Power Pipe Benders would still be the choice of many experienced contractors and electricians — *even if the Blackhawk Bender could only bend pipe.* But, Man! — bending pipe (up to 4"), *and doing it well, is only part of the story!*

Simple attachments can be used with the Porto-Power Hydraulic Unit—to handle tough maintenance jobs, construction work and change-overs. Write for the V-43 catalog or call your Blackhawk Distributor for more details on how Blackhawk Benders can do all this extra work.

•

PULL DRIVE PULLEYS AND GEARS — Smoothly, safely. No crowbars! No sledging!

•

LIFT MACHINERY — Raise a 10-ton load from a low of 3½" to an 8½" height.

•

BUILD YOUR OWN PRESS — Free blueprints! Use the powerful hydraulic unit furnished in the pipe bender.

•

A JACK FOR ANY SPAN—ANY ANGLE — Your Blackhawk power unit is the most refined hydraulic jack available today!

BLACKHAWK

BLACKHAWK MFG. CO.
Dept. P2093, Milwaukee 1, Wisconsin

Rush your new Hydraulic Equipment Bulletin V-43 to us.

Name.....

Company.....

City and State.....

of manufacturing of the Tube Division of the G-E Electronics Department. He will be responsible for all G-E tube manufacturing activities at Buffalo, Cleveland, Lynn and Schenectady. For the present Mr. Gillen will make his headquarters at Nela Park, Cleveland.

Carl C. Coon has been appointed G-E wiring materials field representative in Virginia and North Carolina with headquarters in Roanoke, Va. He replaces J. M. Murphy, who joined the Navy.

GRAYBAR APPOINTMENTS

Charles S. Powell has been appointed manager of the Communications and Merchandising Department at headquarters offices in New York.

Mr. Powell's place as district manager at Boston will be taken by W. H. MacCrellish, now district manager at Cincinnati. The new district manager at Cincinnati will be A. D. Hammond, now manager at Birmingham. Douglas Wallace, now sales manager of the Communications and Merchandising Departments at New York headquarters, will become district manager of Pittsburgh. A. R. Loughborough, now district manager at Pittsburgh, will retire on December 31st, after 39 years of service. Until that time Mr. Loughborough will act in a consulting capacity at Pittsburgh.

POWELL

PAINE COMPANY APPOINTMENTS

The Paine Company of Chicago, Ill., announces the appointment of the following Pacific Coast representatives.

The Milnic Co., 119 Harrison St., San Francisco 3, will cover Fresno and Northern California, also Nevada north of Las Vegas.

H. H. Van Luven, 307 East Third St., Los Angeles 13, will cover Bakersfield and southern California and Arizona.

W. W. Wheat & Sons, 560 First Ave., South, Seattle 4, Wash., will cover Washington, Oregon, Idaho and Western Montana.

Bulldog Electric Products Co., Detroit, has announced the appointment of H. H. Benfield as Eastern Division Manager to supervise and direct the activities of the District Offices of Boston, New York, Washington, Philadelphia, Syracuse and Buffalo. Mr. Benfield will make his headquarters at the New York Office, 101 Park Avenue.

Solar Manufacturing Corporation and Solar Capacitor Sales Corporation announce the removal of general offices to 285 Madison Avenue, New York 17, N. Y., from the Bayonne, N. J., plant. The departments occupying the new quarters are accounts, credits, sales and export.

TOPS IN TIME SWITCH QUALITY

for only $13.00 LIST . . .

The Paragon 300 Series includes ALL the essential features of truly top quality time switches . . . yet the list price is only $13.00. Some of the features are: only 2 exposed gears, all others operate in a sealed oil-filled chamber; slow speed motor; sturdy clock train; snap-action switch; simple hand trip; attractive modern case; 2000% more dial power than required. Satisfactory service, workmanship and material guaranteed. Send for complete bulletin.

PARAGON ELECTRIC COMPANY
401 So. Dearborn St. Chicago, Ill.

Paragon Chicago
BUILDERS OF ELECTRICAL EQUIPMENT . . . . SINCE 1905

SIMPLICITY PLUS!
NEW NON-INDUCTIVE CABLE RACK for INDUSTRIAL PLANT WIRING

Standard Type D-F 3-phase rack converted to 4-wire 3-phase by attaching type F-S Support for supporting fourth conductor. Racks available for Cable sizes from 5/16" to 2¾"

Radically different, the new M. & W. Non-Inductive Cable Rack is designed for A.C. or D.C. systems. Racked cables only partially surrounded by metal eliminates any chance of induced current in the rack. Impedance reduced with cables mounted in delta formation. Rack of one-piece construction . . . installation of cables made quick and easy through the use of split bearings.

Send today for Bulletin C-S-51 . . . describes these and other M. & W. items.

Hook-Mounting and Bar-Type Cable Racks • Messenger Wire and "Bull Dog" Conduit Hangers • "Bull Dog" Insulator Supports • Ground Clamps

THE M. & W. ELECTRIC MANUFACTURING CO., INC.
EAST PALESTINE, OHIO

[FROM PAGE 45]

With amplifiers and a "relay" tube like the thyratron they control all kinds of machinery or devices by light beams, reflection, changes in lighting or interruption of invisible beams. The familiar photoelectric door openers, counters, sorters, burglar alarms and safety devices all depend upon this versatile control tube.

7. Voltage control tubes or glow tubes, have characteristics which give an accurately controlled voltage across the tube regardless of the current flowing through it. With other tubes in appropriate circuits these tubes provide automatic load or control voltages independent of line voltage changes.

8. Cathode ray tubes have an electron beam striking a fluorescent surface with control elements to divert its course. These tubes are widely used in instruments for the analysis of electrical circuits. They are also, of course, the heart of television.

9. X-ray tubes are a specialized type of electron tube which have important industrial uses for testing and analyzing materials.

Electronic apparatus usually contains more than one type of tube. Welding control, for example, may have ignitrons, to switch the welding currents; thyratrons to control the ignitron; pentodes, voltage control tubes and rectifiers to provide the timing control. And in the circuits providing the various operating voltages and links between the tubes we find most of the complications which are baffling to electrical men who have no background in radio or communications.

Operating power for the various parts of the apparatus is usually provided from a transformer with separate secondary windings for heater and plate supply. A rectifier and simple condenser filter usually provides the necessary d.c. plate voltage. From here on the bias voltages for control grids are provided by a method less familiar in conventional electrical apparatus—resistance voltage dividers. The common circuit elements such as resistors and condensers, have the same function in electronic circuits as in any other electrical circuit.

The course of electronics in industry, its progress and acceptance will depend pretty much on how ready we are to take over the application, installation and service. Confidence in the new apparatus can be built only on a substantial base of knowledge.

Latrobe PRODUCTS

★ FLOOR BOXES ★ WIRING SPECIALTIES ★

HIGH QUALITY

EASILY INSTALLED

No. 110 LATROBE WATERTIGHT FLOOR BOX

Cutaway view shows how tapered unit receptacle fits tapered opening in top of box body. Few parts. Easily installed. Ample wire space inside the box.

No. 284 Nozzle with No. 200 Cover Plate

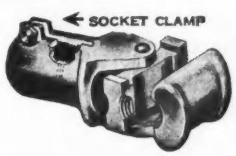
A double duplex nozzle with ½ in. brass pipe extension—or if preferred ¾ in. pipe extension. A very neat and highly regarded watertight floor outlet.

LATROBE PRODUCTS *are* Quality Products

In thousands of installations through the nation Latrobe Floor Boxes and wiring specialties are serving with notable success. Designed for quick installation they are saving valuable time. Yet their high quality and efficiency place them easily in the forefront in their field. Absolutely tops for all war emergency and civilian jobs.

No. 280 Nozzle

Shown in No. 200 cover plate. Ten amp. 250 volt receptacle. Brass housing, mounted on ½ in. brass pipe extension 3 in. long. May be had with longer pipe extension.



No. 625 Latrobe Conduit Bender

Very sturdy. Made of "Tuf-a-loy" steel. Reversible jaw. Internally threaded socket. Will not break. Will not slip. Will not kink conduit.

DURABLE

ECONOMICAL

FULLMAN MANUFACTURING CO. QUALITY AT LATROBE SUPREMACY LATROBE, PA.

FULLMAN MANUFACTURING CO.

LATROBE . . . PENNSYLVANIA

UMI

MINERALLAC

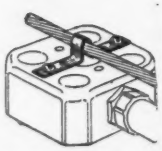
New Practical Unit to Cut Installation Time

● The "Messenger Hanger" and the "Messenger Strap" fill the need for an economical, practical, time-saving unit for use with the new messenger cable type of installation. Mechanically strong, durable, lightweight. They have considerable material and are easily and quickly installed. Our bulletin gives full and complete details—send for it.

See your Jobber.

"Messenger Hanger" for Conduit and Cable

Strong, made of Cadmium Plated Steel or Everdur. Top loop of hanger grips messenger cable to permit conduit to be put in place without failing off.



"Messenger Strap" for Outlet Boxes

Of Cadmium Plated Steel or Everdur. For messenger cable installation to be used with Mineralac "Messenger Hanger." Fits all standard outlet boxes and ¾" messenger cable.

MINERALLAC ELECTRIC COMPANY

New York City Office 50 CHURCH ST. THEODORE B. DALLY

25 N. Peoria St. Chicago

MULTI REFLECTORS

A NECESSITY FOR SUCCESSFUL INSTALLATIONS . .

RLM INDUSTRIAL REFLECTOR

TWO-PIECE GLASSTEEL DIFFUSER

● Start right . . . use MULTI REFLECTORS . . . then regular inspection and maintenance and you can't give your customers better industrial installations, with good profits and complete satisfaction guaranteed. Send for complete catalog.

MULTI

ELECTRICAL MANUFACTURING CO.

1840 W. 14TH ST., CHICAGO, ILL.

MORE GOSSIP

Short But Inclusive

They don't waste words down in Virginia. W. Edward Dunn, electrical inspector of Alexandria, Va., has his work cut out for him by a simple four paragraph electrical ordinance recently passed by the city council.

The ordinance requires:

1. Compliance with the National Electrical Code, as amended, for the installation of all electrical work within the city.

2. A certificate for the sale of overcurrent devices.

3. The approval of the National Board of Fire Underwriters on all electrical wiring supplies, fixtures, appliances or other electrically operated equipment.

4. The inspection of all electrical supplies for sale permits the electrical inspector to cause removal of any which do not meet the requirements.

The certificate for the sale of overcurrent devices is issued only after the applicant has shown that he possesses a knowledge of the requirements of these devices. The certificate is issued for a fee of $1.00 per year and does not apply to any person holding a Master Electrician's Certificate.

Manahan Retires

When R. H. Manahan, chief of the electrical division, Department of Building and Safety of the city of Los Angeles, Calif., retired from active duty on July 1, the city lost the senior, from point of service, of all its city employees. His retirement concludes 44 years of service in the electrical departments of the city.

Mr. Manahan's first contact with the electrical industry was in 1895 when he was a helper to a Pasadena electrical contractor. Then he went with a railroad as electrical engineer and with a utility company. He was employed as an electrical inspector by the City of Los Angeles in 1899 and steadily advanced until he was appointed chief of the electrical division of the Department of Building and Safety in 1925—the position he held at retirement.

A continuous and active interest in electrical inspection affairs led Mr. Manahan to become a charter member and president of the California Association of Electrical Inspectors; charter member and president of the IAEI. He is a member of the Executive Council, IAEI and since its organization has been a representative of the IAEI on the Electrical Committee, NFPA; and for many years has been a member of the Electrical Council of Underwriters' Laboratories.

Fellow workers honored Mr. Manahan at a dinner at which the City of Los Angeles presented him with a framed sheepskin resolution. His department and other organizations presented him with many useful gifts of appreciation for his long years of service.

SEARCHLIGHT SECTION

(Classified Advertising)

Employment • Business Equipment (Used or Resale)

"OPPORTUNITIES"

UNDISPLAYED RATE

15 Cents a Word, Minimum $3.00. POSITIONS WANTED (full or part time salaried employment only), ½ above rates, in advance. BOX NUMBERS—Care of publication New York, Chicago or San Francisco offices count as 10 words.

DISPLAYED RATE

Rate: $7.50 per inch for all advertising other than contract. Contract rates on request. AN ADVERTISING INCH: ⅞" on one column, 3 columns—30 inches—to a page.

SALESMAN AVAILABLE

MANUFACTURERS' AGENT covering Washington, Oregon, Idaho wishes to take on new lines. Now calling on wholesale and retail trade, Army and Navy. Covering priority and non-priority accounts. Can give your line good representation in this territory on commission basis. Write William Haas & Co., Terminal Bldg., Seattle, Wash.

Electrical Public Relations Advertising Executive Available

Now Public Relations and Promotion Counsel to two important electrical associations. For ten years Advertising Promotion Manager electrical manufacturer. Creates plans that sell now or for the post-war period. Good organizer. Initiated war-time advertising and war plant conservation, employee training incentive production plans for employer. Familiar all markets as sales manager. Effective placing publicity. Good post-war ideas. Salary substantial. Employed. 44.

PW-304, Electrical Contracting, 330 West 42 St., New York 18, N. Y.

SALES ENGINEER

Electrical, having good following in Marine & Industrial field. Would consider additional lines, or service engineering in Los Angeles, or Pacific Coast.

RA-306, Electrical Contracting 68 Post St., San Francisco 4, Calif.

FOR SALE

TRANSFORMERS

3—200 K.V.A. Single Phase Westinghouse Transformers 13200 to 2400 Volts, Subtractive Polarity. Complete information upon request.

Enterprise Electric Co. of Md., Inc.
25 East Lee Street Baltimore, Maryland

CLOSEOUT

1,000 FAN DUTY MOTORS

Black & Decker
Robbins & Myers

H. U. MANN

540 Lake Shore Drive CHICAGO

Frykman Retires

Oscar M. Frykman, Chief Electrical Inspector of Minneapolis, Minn., retired from active duty June 30, after 33 years of service in the Electrical Inspection Department of that city. On the eve of his retirement he was honored at a testimonial dinner sponsored by all branches of the electrical industry in the Twin Cities area, receiving a handsomely engrossed testimonial from the North Central Electrical Industries on behalf of the electrical contractors, wholesalers, utilities, inspectors and electrical workers.

Mr. Frykman's first connection with the electrical industry was in the communications field. From 1899 to 1906 he was connected with various telephone enterprises. During that time he perfected and had patented the double button microphone and circuit, now known as "push-pull". In 1907 he launched an electrical contracting business in Minneapolis and abandoned this in 1910 to become assistant city electrical inspector. He was appointed chief electrical inspector in 1912. For the next 23 years he also served as treasurer and examiner of the Minnesota State Board of Electricity.

Mr. Frykman's interest in inspector activities led him to become a charter member of the Electrical Council of Underwriter's Laboratories; past-president of the Minnesota Electrical Inspectors' Association; and past-president of the Western Section, IAEI. Although his long service to Minneapolis is terminated by the new Municipal Employees' Retirement Plan, Oscar, as he is known to his many business friends, plans to forego any extended vacation at present and become affiliated directly with the war effort.

Lighting Coordinator

Lighting Coordinator for Oakland, is the newest title that B. C. Hill carries. In addition to being the superintendent of the electrical department, Oakland, California, he is third vice-president of the International Association of Electrical Inspectors.

OCD Coordinator

More responsibility has been placed on the shoulders of Harry Jenkins, city electrician of Bellingham, Wash. He was recently appointed Coordinator of Civilian Defense for the Bellingham district.

Inspector Paulsen Retires

Charles M. Paulsen, electrical inspector for the city of Chicago for the past 20 years, recently retired from active service in the Electrical Inspection Division of the Department of Streets and Electricity. Mr. Paulsen was employed by the city of Chicago as an electrical mechanic in 1921 and was promoted to the rank of inspector in 1923. Despite his retirement, he will retain his connection with the IBEW and IAEI.

TEMP-O-RISE THERMOSTAT

This thermostat embodies two principles in fire detection, one principle working on the rate of rise of temperature for early detection of a fast burning fire. Also the fixed temperature principle for the detection of slow burning and dangerous smouldering fires which cannot be detected by the rate of rise principle until the flash of the accumulated gases—which may be far too late.

By the use of both principles of fire detection, no fire can escape early discovery by this spot thermostat. It is made in four models—

Model #101—Rate of rise and fixed temperature operating at 165° Fahrenheit.

Model #102—Rate of rise and fixed temperature operating at 212° Fahrenheit.

Model #103—Fixed temperature only operating at 165° Fahrenheit.

Model #104—Fixed temperature only operating at 212° Fahrenheit.

Each thermostat covers 30 x 30 feet of ceiling space. Approved up to 110 volts AC-DC.

We are manufacturers of Underwriters' Approved Fire Alarm products covering the entire field of fire protection. Class A proprietary systems . . . Non-code fire alarm systems . . . all classes of switches and coded transmitters for supervision of automatic sprinkler equipments . . . complete thermostatic fire alarm systems . . . watchman supervisory systems . . . manual fire alarm systems.

Complete plans and instructions furnished for installation, operation, and maintenance. Approved for use by the Army, Navy, and other government departments, also approved by Underwriters Laboratories and Associated Factory Mutual Laboratories.

For information write to

CENTRAL STATION SIGNALS, INC.

71 West 23rd Street, New York 10, N. Y.

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This
NEWSPAPER
advertisement was published in Washington, New York and Chicago by McGraw-Hill, to make friends for business.
COURT

DEMOCRATS *need "Seed Money," too*

Seed Ideas and Seed Money

Whether you run a whole business, a plant or a section, the very fact that you hold this magazine in your hands indicates that you are interested in *improvement*.

Did you ever stop to think that that instinctive desire to find a better way of doing things is the fundamental driving force of America?

It is.

If allowed to function in an environment economically and politically favorable to industry, this American instinct for improvement can carry us forward to undreamed standards of living and of culture.

The only barrier to constant improvement is lack of public understanding.

Industry cannot have a favorable environment, however, until industry itself clearly defines its objectives, and explains them clearly to every citizen *in terms of social progress*.

This Seed Money advertisement (reprinted from the McGraw-Hill newspaper campaign now running in Washington, New York and Chicago) is intended as a starter in a nation-wide process of education on the source of good living.

Some companies are running the Seed Money Advertisements locally, over their own signatures. Others are starting their own campaigns. Either way, the Seed Idea is being planted.

If you would like to reproduce this message in your plant city, free mats and booklet reprints (sold at cost) are available.

James H. McGraw, Jr.
President

McGraw-Hill Publishing Company, Inc.

NOW don't get excited, folks, this isn't a political advertisement. We've got some thoughts on our mind about how to make big problems simple, and we are using the word "democrat" the way the men who thought it up used it.

More than 2,000 years ago, the Greeks decided to quit believing in Superman, and they invented this word to express their general idea.

► Every schoolboy knows how that idea was pulled off the shelf sometime back, and a form of government hammered out that would allow Joe Doakes enough personal elbow room to do his stuff in the world.

Every schoolboy knows, too, that what followed—particularly in America—was the most rapid development ever known.

Within the memory of living men, we have traded the economy of the hoe for the tractor, the muscle for the motor, the eye for the electronic tube.

So vast has our mechanical might become that by shifting the ends of our production lines from the garage, the kitchen and the living room to the skies above Italy, Germany and Japan, we are changing the history of the whole world.

With all this glory to his credit, wouldn't you think the common man would know how he did it,

[FREE MATS: If you would like to publish this message over your own company name, or distribute it in handy booklet form, write or wire: Research Dept., McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York (18), N.Y.]

DEMOCRATS *need "Seed Money," too* (cont'd)

and how to keep on the road to better living after the war?

He doesn't know, because he discounts the part that his own, native love for *improvement* plays in our national life.

This love for *improvement* started on pioneer farms. It continued in millions of garages and kitchens. It rides with every American gunner today.

American *improvement* is essentially a Joe Doakes affair. Here's how it works:

1. Joe invents something and invests Seed Money in equipment and materials to make it.
2. People buy it.
3. That makes good paying jobs.
4. Joe invests more Seed Money to improve his product or his method of making it.
5. More people buy it.
6. That makes more good paying jobs.
7. Joe invests more Seed Money in more and better machines, to get volume production.
8. So, Joe lowers his price.
9. Still more people buy.
10. That makes more good paying jobs.

Try to figure out any other foundation for American wealth, leisure, culture, fighting strength or material possessions!

► This simple progression, multiplied by millions of instances, explains why "Seed Money" is so important in our national life.

Seed Money is used every time a product or a machine is improved, because Seed Money means "that part of profit which is 'plowed back' into a business."

Joe Doakes will need his Seed Money, to attract customers and create jobs when this war is over. But a dangerous percentage of Joe's Seed Money is being blotted up in the Excess Profits Tax.

Perhaps our government intends to return some of this money after the war, as a loan. But this would mean another government bureau, more Federal employees, all of which will further increase the cost of government. But above all—Business will not be free to "take a chance" with this money. It belongs to the government. Hence, the "take a chance" spirit, the life breath of progress, will be hobbled just when Americans need it most.

► There is a simple and much more effective way to supply our American industry and commerce with Seed Money.

Change our tax laws to permit industry and business to set aside from present earnings the tax-free Seed Money that they will need to reinvest in improvement of plant, products or essential operations to create jobs after the war.

To put this simple, effective procedure into practice, our government must change its attitude toward the source of all improvement—Seed Money. To bring this about, remind your Congressman that:

"Industrial Progress
is the Source of all Good Living."

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

24 publications, which gather "war-news" from the "war-production-front" through a staff of more than 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

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The interchangeable features of the P&S-Despard Line mean more than ever in these days of limited stocks.

Just the thing for that next job — T-rated switches, double-grip outlets, pilots and accessories.

Keep your P&S catalog handy — Send for a new one if yours is out of date.

SOLD THROUGH
ELECTRICAL WHOLESALERS

PASS & SEYMOUR, INC.
SYRACUSE, N.Y.

Transformer Maintenance

[FROM PAGE 47]

fraction of a teaspoonful of water in a barrel of oil will necessitate filtering.

The first thing to check to determine the condition of the transformer is the oil. The samples of oil for test should be drawn from the bottom of the tank. Good oil will test about 22,000 volts in a standard test cup. If the oil tests at a lower value than this, presence of moisture is indicated and the oil should be dried in a filter press or centrifuge.

Chlorinated Diphenyl Transformers

When installed indoors, oil-filled transformers must be isolated in vaults for fire protection and safety. The use of an insulating and cooling medium which is at the same time non-inflammable and non-explosive does away with the expense of enclosures and allows more latitude in locating transformers close to load centers. The chlorinated diphenyl filled transformer is one answer. Chlorinated diphenyl is a synthetic non-inflammable and non-explosive insulating and cooling liquid, straw-yellow in color, with a specific gravity of 1.564 (at 60 deg. F.) and a Saybolt viscosity of 54 seconds at (100 deg. F.). It is used under several trade names.

The dielectric strength of chlorinated diphenyl compares favorably with and under average normal conditions will be found higher than that of transformer oil. The same precautions are necessary with chlorinated diphenyl as are taken with transformer oil. It should be kept free of moisture, lint, and dirt. Mineral oil is completely miscible with chlorinated diphenyl. It is practically impossible to separate the two when mixed; therefore, it is important to avoid contamination with any oil as the presence of such material markedly changes the non-inflammable and non-explosive characteristics of chlorinated diphenyl.

Chlorinated diphenyl has an irritating effect upon the skin. It is more pronounced to some persons than to others. Especially the eyes, nose, and lips are affected when coming in contact with the liquid and certain safety precautions must be observed when handling it. When working with the hands in chlorinated diphenyl, it will irritate skin eruptions with certain individuals due to absorption through the pores of the skin.

Cleanliness among workmen is essential and a very good safeguard against such effects. An application of castor oil is recommended for the eves and castor oil or cold cream for the nose and lips. In case chlorinated diphenyl comes in contact with the skin, the part should be thoroughly washed and given cold cream treatment. Special gloves are available for handling the liquid. Hot transformers should be opened only in well-ventilated places.

Chlorinated diphenyl may be dehydrated and filtered by means of an oil filter press, but in order that it may not be contaminated with oil, it is necessary that the filter press be used for this liquid only. A different procedure than that followed for oil is required to purify chlorinated diphenyl. Contamination cannot be removed entirely by filter paper alone. To clean thoroughly, "activated clay" must be used as a filter medium which absorbs impurities. In practice, it is only necessary to pass the chlorinated diphenyl through the clay and then to separate the clay mechanically from the liquid.

Gaskets should be made of high-grade cork. Use a red gasket cement of the shellac and iron oxide type especially developed for use with chlorinated diphenyl. This cement should also be used for leak proofing all tank connections and pipe fittings.

Air-Cooled Transformers

Air-cooled transformers are designed for installation in buildings where it is desirable to avoid the construction of a protective vault. They are made in ratings up to about 500 kva., with a top voltage of 13,200. Windings in these transformers are usually designed for a temperature rise of 75 deg. C. Insulation throughout is Class "B", the materials including porcelain, asbestos, mica, glass, and air. This permits operation at higher temperatures than are permissible in the case of liquid-filled transformers.

Periodic load and temperature checks should be made as is the rule for conventional transformers. In operation, the air ducts collect dust and dirt and it is necessary to clean the transformer at regular intervals. The frequency of cleaning will depend on the load and especially on the amount of dirt in the cooling air. Use a maximum air pressure of 50 pounds when blowing out dirt. Do not use air until it is free from moisture that may have accumulated in the line from condensation.

General

Because of their excellent operating record, transformers are not always properly inspected and maintained. Periodic mechanical inspection, and load and temperature tests should be made on all transformers—large and small.

Check the load with an ammeter. If the time of maximum load is not known, make the test over a period of 24 hours. If there is unbalance in the line leads try to correct.

Sample and test oil at least once a year, oftener if necessary. Make insulation tests with a Megger once a year, oftener if water is found in the oil. Record all these readings and keep the charts up to date.

Gaskets are important whether the transformer is indoor or outdoor. It is necessary for trouble-free operation that all openings in the tank be tightly sealed. Use cork or neoprene cork for oil-filled transformers and cork only for chlorinated diphenyl. Weld stops on flanges to control compression of gaskets. Compress cork to one-half the original thickness; neoprene cork to two-thirds. Use an oil and chlorinated-diphenyl resistant cement.

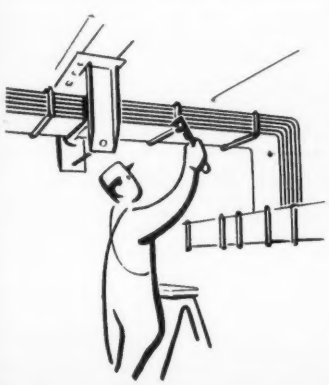
Check Connections Often

All connections both inside and outside the transformer should be inspected to see that they are tight. Look for discoloration of copper. Any connections that show signs of having been hot should be thoroughly cleaned and bolted together tightly.

Keep all bolts and nuts tight. Keep terminal boards clean and all connections and connection straps tight. If low oil exposes terminal board, flashovers are likely to occur.

See that all "plumbing" is in good condition so as to avoid oil leaks. Correct oil syphoning from leads by stripping a section of insulation above the oil level and soldering strands of cable solidly together for two inches.

Clean and paint all tank, cover, and radiating surfaces. Select paints with good heat transfer qualities. Investigate unusual noises, sudden changes in oil level and rupturing of relief diaphragm at once.



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If your insulated power cables are loaded to their limit and there is a demand for more service, you must do something about it. In times like these your decision what to do will be influenced by shortage of materials, military requirements, priorities, and manufacturing restrictions.

You may find that instead of replacing an old cable with a larger one, better results can be obtained by installing an "assistant cable" in parallel with that now in service. If that can be done you will not only keep your old cable in service but you may carry your full load with less copper than would be required for complete replacement of your present cable installation.

To get best results, any cables you buy should be designed by cable engineers to fit the job they are to do and at the same time to get maximum use of the critical materials that go into them. If you need cables for essential work let us tell you more about Simplex cables.

Simplex WIRES and CABLES

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

ARMY NAVY E

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ELECTRIC PLANTS

Electricity for Any Job—Anywhere

ONAN GASOLINE DRIVEN ELECTRIC PLANTS provide electricity in any location where it is not otherwise available, and for emergency and standby service.

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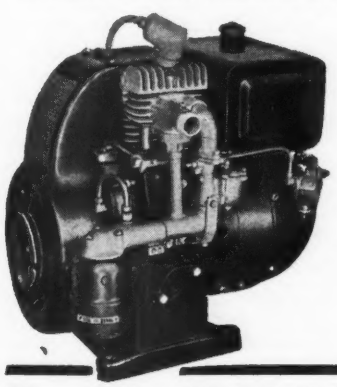

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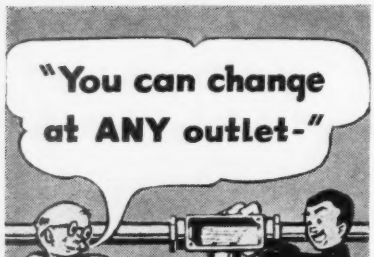


—attach THIN-WALL TUBING in place of Thick-Wall conduit (or make a Threaded connection)

Use ANY kind of conduit with a Kondu fitting, and make either a Threadless or Threaded connection.

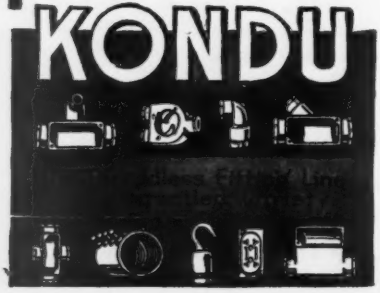
Just slip out one bushing and slip in another. No extra pieces are needed to make the change.

Every Kondu box is a union, and can be taken out of the line without disturbing conduit. Or can be put in after the conduit is installed.

Practically unbreakable, Kondu fittings are 100% reusable. Self-aligning, they are quickest to install, and hold permanently tight . . . vibration-proof.

Write for the Kondu Catalog.

KONDU CORPORATION
Erie, Pa.



Light Conditioning For Arc Welding

[FROM PAGE 50]

visible spectrum near the eye's peak of sensitivity.

Illumination Intensity—A comfortable upper limit of 150 foot-candles of mercury lighting was chosen for general illumination in the welding area.

Spacing of Units—To cover an area of approximately 20,000 square feet, 370 lighting fixtures were installed on 7-ft. by 8-ft. spacings.

Paint—Choice of a zinc oxide base paint for reflecting surfaces such as walls and girders was made after a study of the range of paints with low ultraviolet reflectivity. The choice of such a paint reduced anxiety over ultraviolet burns from reflected radiation.

Workers Goggles—Investigation was made of the safety goggles for non-welding workers in the area. Number 4 lenses were chosen to protect them from any harmful radiation directly within their view. Since their viewing distance is usually three times that of the welder and with 150 foot-candles of general lighting, there is always sufficient illumination to permit them to safely see through their lenses.

Masking Borders—After the installation had been completed, it was suggested that several welders mask the borders of the welding seam with white asbestos tape, set at a slight angle on either side of the seam. This added to the sense of comfort and increased the clarity with which the welder saw the line upon which he was working.

Under low illumination levels and harsh contrasts, the actual welding operation often appears to be accompanied by clouds which seem to rise from the arc. Marmon-Herrington welders maintain that under high-level general lighting this cloud effect is materially reduced and often non-existent. Not only is the eye comfort of the welder increased, but employees in non-welding tasks now go about their work in close proximity to the arcs and experience a freedom and relaxation that is not present when bright arcs are periodically flashing in comparatively dark surroundings. The net result is an all-around increased production efficiency in the department.

Lighting for welding is a comparatively new science with no definite standards yet established. Undoubtedly there will be additional experimentation in the near future. That it can do a good job was proved by the Marmon-Herrington Company. It now awaits warranted consideration by others.

EVERY PHASE of electrical maintenance and repair work covered in this library

5 volumes of practical how-to-do-it information

Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.

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2042 pages, 1721 illustrations and diagrams

These books show you how to

—install all types of motor and generator units;
—locate breaks in armature windings and do a workmanlike job of rewinding;
—know just what is wrong with an electrical machine and take charge of installation and maintenance work;
—make accurate tests of switchboards and apparatus and correctly balance the power with the load;
—handle every sort of wiring job;
—show competence whether it be in the use of a Stillson wrench or a Wheatstone bridge.

Includes trouble-shooting book

Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a book giving helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery trouble, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

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Sterilamp Installation

[FROM PAGE 51]

The lamps are tested periodically by an ultra-violet ray meter; when the u.v. output drops to a certain predetermined figure the circuits get a 3 volt boost. Lamps were originally guaranteed for six months but by this voltage boost method, the average life of the lamps have been increased from 12 to 14 months.

The differential of 30 deg. in temperature from the process to the chill room caused condensation within the conduit passing from the cold to the warm room. To remedy this situation a C condulet was placed against the wall at the point where it entered the warm room, the condulet was filled with a compound and the internal sweating was thus entirely eliminated.

The Sterilamps are only an accessory to the process. The warm temperature alone is responsible for weakening the connective tissues in 72 hours, giving tender beef. The high humidity allows the meat to retain its juices whereas in the original process the lower humidity allowed these juices to evaporate. The sole purpose of the Sterilamps is to prevent the growth of bacteria thus permitting an increase in temperature.

This germicidal lamp however is not limited to the steak tenderizing process. It is used for the same purpose, retardation of bacterial growth, in all kinds of fruit, vegetable and food processing in general. These lamps are also in extensive use at present in hospital operating rooms, and sick rooms; in offices, school rooms, theaters and even in some homes. Tests have shown that a sharp decline in the spreading of colds can be made by the installation of ultra-violet tubes in offices. Predictions have been made that in the near future germicidal lamps will become as normal a complement as illumination fixtures in all buildings—offices, churches, theaters, eating places, hotels and homes and even extended to train, plane, bus and ship usage. The field is unlimited.

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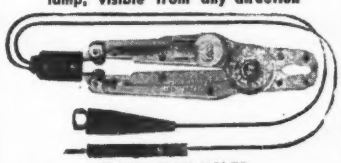

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Can be obtained from G. E.—Westinghouse, or other first class jobbers

START TEST POCKET PLIERS
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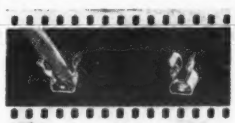

Make this test: Actual moving photo of test with screw driver. Note clip's return to perfect form.

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LITTELFUSE Beryllium Copper FUSE CLIPS show spring qualities equal to steel. Other characteristics: High fatigue resistance and tensile strength. *Grips fuses tighter.* Write for Bulletin.

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supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical operation, maintenance and service. Make a habit of checking this page, each issue.

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Magnetic Contactor

Coil wound to keep cool on *continuous* duty. Electrically held. Full floating armature—minimum hum. For *severest* duty. Withstands surge of type C lamps. Used as motor starter, *blackout switches*, emergency controls, X-Ray, etc. Used in war production plants. 30 to 400 amps, A.C. to D.C.

Full Line of Control Equipment shown in Zenith Catalog. Send for it.

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Electrical Connectors

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by all authorities
by all users everywhere

Efficiency . . . dependability . . . economy . . . ILSCO PRODUCTS give you *everything.*

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Seamless copper tubing is drawn down to size in our own plant.

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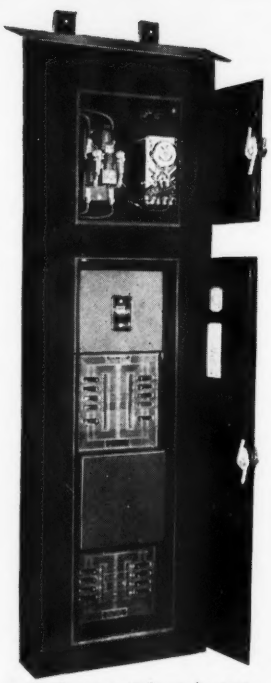
★ These companies have included Briefalogs, containing additional buying information on their products, in the 1943 edition of the Electrical Buyers' Reference.

Airport Electrical Equipment

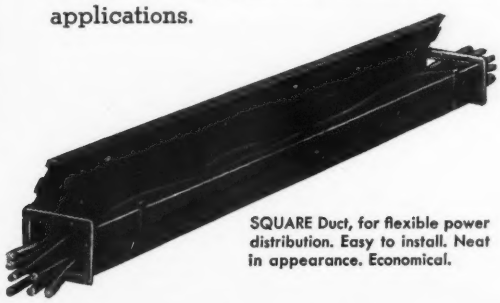
PANELBOARDS SWITCHES CIRCUIT BREAKERS DISTRIBUTION SYSTEMS STANDARD & "TAILOR MADE"



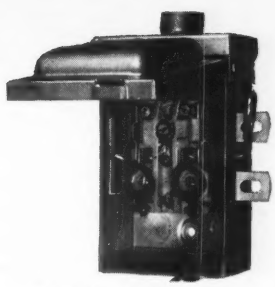
Basic airport control panel, an example of Square D tailor-made equipment. Provides automatic timing feature and remote control.

THERE is a surprising amount of airport building activity right now—and plenty more ahead when aviation spreads its peacetime wings. Don't overlook this source of substantial business—now and in the days ahead.

When you're figuring such jobs, you'll find that many of Square D's standard devices are ideally suited for airport installations—indoors or out. Your nearest Square D Field Engineer will work with you and with our staff of design engineers in building special equipment for individual applications.



SQUARE Duct, for flexible power distribution. Easy to install. Neat in appearance. Economical.



Raintight safety switch, one of many models and types.

Raintight circuit breakers are available in a wide range of sizes and capacities. They afford modern convenience and protection—eliminate fuses completely.

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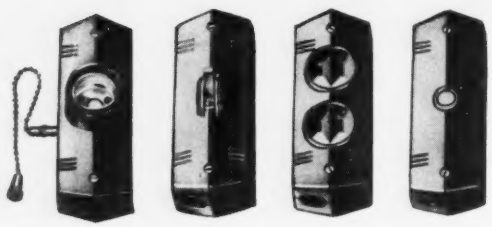
"THE "Watch Dog"

A New G-E FLUORESCENT STARTER
with Rated Long Life

Here is the starter to use for efficient maintenance of fluorescent lamps. It has an average rated life of three years under specified test conditions.

This manual reset starter for 40-watt lamps is called the "Watch Dog." It provides precision starting which helps prolong lamp life and starter life. In addition, it locks out dead lamps quickly and positively thereby eliminating blinking. This action also prolongs the life of the starter.

Moreover, the "Watch Dog" starter enables a dead lamp to be removed immediately. No cooling period is required. It is reset easily to guard a new lamp simply by pressing a button.



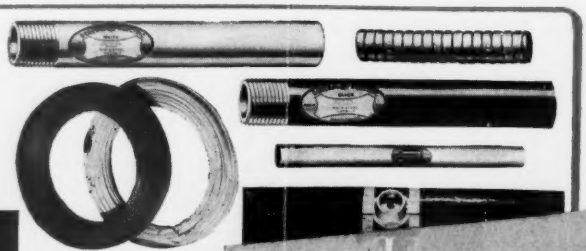
MONCOR SURFACE WIRING DEVICES

These good-looking devices are ideal for surface wiring in war housing and in war-purpose industrial buildings, warehouses etc. Their use saves time and materials. Knockouts in the ends, sides and backs of these devices enable them to be end-connected, side-connected (knob and tube or cleat wiring) or back-connected for concealed wiring.

FOR FURTHER INFORMATION about G-E wiring devices, wires and cables and conduits, see the nearest G-E Merchandise Distributor or write to Section CDW- 931-18, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

G-E CONDUITS AND BUILDING WIRES

There are G-E conduits and building wires for every purpose: White and Black rigid conduits, EMT, flexible conduit, Fiberduct and various building wires including Type SN small diameter thermoplastic insulated.



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